Wellington

PHOTOGRAPHIC HANDBOOK

SEVENTEENTH EDITION

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THE . . Wellington Photographic HANDBOOK

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CURIOSITY

Photograph by F. W. Murrell on a Wellington Spectrum Plate.
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PREFACE.

THE first edition of the WELLINGTON HANDBOOK, published about 25 years ago, was a little brochure of some 30 pages, dealing with the development of Bromide Paper. As new products were added to the list of Wellington manufactures, further editions became necessary, each one larger than its predecessor. Soon the work outgrew the brochure stage and appeared as a slim volume in stiff paper covers, followed soon after by the first cloth-bound edition. To-day the WELLINGTON HANDBOOK, a volume of 154 pages, is easily the most widely read photographic text-book in existence.

It has been translated into French, Spanish, Portuguese, Danish, German and Japanese, and thousands of amateur and professional photographers attribute their success to the practical instruction contained in its pages.

In the present edition the article on the Bromoil Process has been rewritten to make the instructions more suitable for the improved Wellington Bromoil Paper recently placed on the market. All other articles have been revised and the formulæ brought completely up to date.

WELLINGTON & WARD, LTD.

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A Chapter on the Camera for the Beginner.

THE object of this book is to help the photographer at every stage of his work from the time when he returns home with his first batch of exposures ready for development. In the present chapter a few notes are given for the benefit of the reader who has either purchased, or is about to purchase, his first camera.

In the choice of a first camera the determining factor is occasionally the matter of cost. Provided he avoids an unduly intricate and complicated instrument, the beginner will do well to buy the best he can afford. At the same time it should be remembered that a camera costing, say, £10, will not always produce better pictures than one costing a fifth as much. The disadvantage of the cheap camera consists chiefly in the things it will not do ; what it can do it does well, and hundreds of pictures of real artistic merit are produced every year by cameras which can be bought for a pound or two.

THE BOX-FORM CAMERA.

For the novice the box-form camera is the cheapest and simplest. The absence of complications reduces the risk of error in manipulation to a minimum. There is no front to adjust and no bellows to pull out. All one has to do is to sight the object in the finder, snap the shutter, and then wind off the exposed film.

Box-form plate cameras were at one time very popular, but of recent years have given place to the simpler and more convenient roll film type.

In its least expensive form the box camera does not require focussing. It is made with the focus fixed, so that all objects at

a distance of, say, 15 feet and over, will be sharply defined on the plate. Objects nearer than 15 feet, or whatever the fixed point may be, should not be attempted. In some models supplementary lenses or magnifiers are fitted which can be placed in front of the principal lens. These alter the focal length and bring objects at, say, 3, 9 and 12 feet, into focus. When these magnifiers are used the distance from lens to subject should be accurately measured. Care should be taken that the magnifiers are pushed out of position when not required for use, otherwise blurred pictures will result.

A third type known as the " All Distance " camera has recently appeared. This is identical with the fixed focus box-form camera, except that the lens can be pulled out a fraction of an inch to bring objects near the camera into correct focus. This is probably the most generally useful low-priced camera in existence.

The box camera will produce excellent photographs of landscapes, street scenes, groups, and the like. Placed on a stand, to allow of prolonged exposure, it can be used for interiors ; but for photographing flowers and small objects, or for copying photographs it is quite unsuitable. Except with the " All Distance " type, bust portraits are also beyond its scope unless magnifiers are used, and even then it compares unfavourably for this work with a focussing camera fitted with a ground-glass screen. The lens with which the box-form camera is usually fitted works at a comparatively small aperture, and consequently a fairly bright light is needed for successful snap-shot exposures.

Some box-form cameras allow of focussing by scale. At the side of the camera there is a scale of distances and a screw or lever actuating the lens front. The worker estimates the distance of the subject, moves the screw or lever to bring an indicator opposite the correct number of feet, and exposes. This form is slightly more costly than the fixed-focus camera, and may be obtained fitted with a better lens to allow of snap-shot exposures in a relatively dull light.

THE FOLDING HAND CAMERA.

The folding camera does not differ in principle from the box camera, but the body instead of being rigid takes the form of a leather bellows, so that when not in use the instrument folds into very small compass. If made to take plates, these are carried in dark slides, which have to be loaded in the dark–room and are placed in the camera one at a time before use. As a rule focussing is done by scale, but with plate cameras a focussing screen is fitted so that, if desired, the picture may be composed and accurately focussed on the ground glass. This is a very real convenience when the camera is used on a stand, especially for portraiture, and it is worthy of note that only in cameras made for plates is this possible. With a film camera the worker must always rely on judgment.

The folding camera, in its more expensive form, is fitted with a rising and falling front, the purpose of which will become apparent if the worker sets up the camera on a stand and focusses on a fairly tall building in the middle distance. On observing the ground-glass screen during the process of focussing it will probably be found that the top of the roof is outside the picture and that there is an excess of foreground. If the front of the camera be now examined it will be seen that the part carrying the lens can be raised or lowered out of its normal position without in any way affecting the position of the camera or focussing screen. The front should now be raised about half an inch, and on again examining the focussing screen it will be seen that a change has taken place in the image. There is now much less foreground and the roof of the building is no longer cut off by the bottom of the screen. This movement is clearly of great value when photographing street scenes and buildings.

A good folding "hand-and-stand" camera, provided with a focussing screen and an anastigmatic lens working at about F/6 is almost all that can be desired for amateur photography, and there is very little photographic work, other than, perhaps, copying to full size, that cannot be accomplished by its aid.

It should be remembered that the possession of a plate camera does not wholly debar the user from the advantages of daylight loading. Film packs, of which the "Wellington Film Pack" is the latest type, can be used in all plate cameras provided with a film pack adapter. In these 12 thin films are carried, each one after exposure being pulled behind the unexposed films by means of a strip of paper attached to the film itself. When all are exposed a strip of opaque paper makes the front light tight and the pack may safely be removed from the adapter in daylight.

THE STAND CAMERA.

A stand camera is really nothing more than a folding camera that cannot conveniently be used without a tripod. Nine-tenths of the readers of this book will probably never use a stand camera, but there are some purposes for which it is indispensable.

Apart from minor details the chief difference between the folding hand camera and the stand camera is that the latter generally possesses a longer extension of bellows and a swing-back movement; also it is more bulky.

It has been explained that the folding camera is not usually suitable for copying to full size. The reason for this will be readily understood. When using a focussing camera the worker will notice that the nearer the subject the larger it appears on the focussing screen and the further must the camera be extended to secure sharp definition. If he seeks to copy a photograph full size with an ordinary folding camera he will probably find that the extension is not sufficient to allow of a sharp image being obtained. The degree of extension required depends on what is called the focal length of the lens, and this term requires a little explanation.

FOCAL LENGTH.

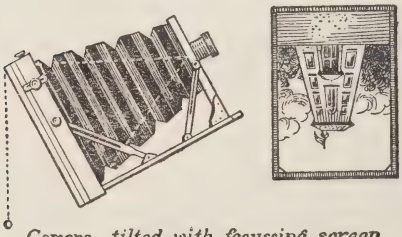
When an object is focussed with a given lens the distance between lens and plate will always be the same as long as the distance of the object remains unchanged. As the object recedes, the distance between lens and plate diminishes until, when the

object becomes very distant, a point is reached beyond which further racking back of the lens is unnecessary. If the distance between lens and screen is now measured it will represent roughly what is known as the focal length of the lens. The actual calculation of focal length is rather more complicated than this, but for the purpose of explanation the foregoing is sufficient.

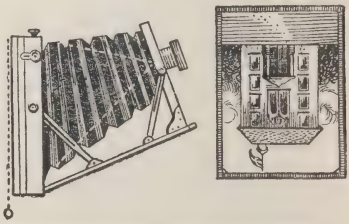
For copying to full size an extension of the camera bellows equal to double the focal length of the lens used is necessary, and this—technically termed double extension—should be provided for in every good stand camera.

THE SWING BACK.

The reader has seen the value of the rising front as an aid to photographing buildings and cutting off excessive foreground ; but he will find some cases where the rise of the lens front is insufficient, and where the only course available is to tilt the camera upwards. Examination of the focussing screen will show that although, thanks to the tilt, the top of the object has now been included, a falling-back appearance has been imparted to the image, and all the vertical lines instead of being parallel converge towards the top of the picture (on the screen this, of course, will be the bottom). The cause of this is obviously the fact that the focussing screen is no longer vertical, and if we can restore the screen to the vertical position while maintaining the tilt of the camera the distortion should disappear. The diagram below shows how the "swing back" of the stand camera allows this to be done :—



Camera tilted with focussing screen out of vertical.



Camera tilted with focussing screen restored to vertical by action of swing back.

It should be noted that the swinging of the back has caused the top of the focussing screen to be nearer the lens than the bottom, so that both top and bottom are no longer in focus at the same time. This difficulty is overcome by focussing as evenly as possible over the most important part of the image and then inserting a stop in the lens sufficiently small to bring the whole into sharp definition.

The foregoing notes will have given the reader a fair idea of the work which each of the principal types of cameras may be expected to perform. In actual fact each type tends to merge into the other, and there are, for example, one or two models of folding hand cameras which are equally serviceable as stand cameras.

Although rather too costly to appeal to the average beginner, mention must be made of the reflex camera, in which the image is reflected upwards to a focussing screen in the top of the camera by means of a mirror, to allow of accurate focussing up to the moment of exposure—a great advantage when photographing animals and children. The act of releasing the shutter causes the mirror to rise out of the way and cover the focussing screen. This type of camera is generally fitted with a focal-plane shutter, which works not in front of or between the combinations of the lens, but takes the form of a blind with an adjustable slit working immediately in front of the plate, or in the " focal plane " as it is called. With the focal-plane shutter very rapid exposures are possible, as brief even as $\frac{1}{1000}$ of a second.

PLATES OR FILMS.

Most beginners in photography will, without consideration, decide to purchase a roll film camera. The advantage of daylight loading, lightness and the practical abolition of the dark room outweigh all other considerations. For many purposes a roll film camera and Wellington Anti-Screen Films will be found all that can be desired. Nevertheless, the best photography is still done on plates.

The plate user has the great advantage of possessing a varied choice in the matter of his material. Roll films are all more or less similar in character, whereas plates are made in a wide variety of grades each possessing its own characteristics. The possibility of selecting a plate to suit precisely the class of work contemplated is one of the great advantages of plate photography.

Furthermore, the plate user can make a single exposure and develop it, whereas the roll film user has to expose the whole of his spool before he can see his results. As a consequence, plate photography possesses the advantage of being the most economical form for the amateur who wishes his photography to take a more serious form than the mere collection of holiday souvenirs.

USING THE CAMERA.

When making his first exposures the worker should select for preference a fairly bright and clear day. If he possesses a fixed-focus hand camera he has only to sight the object in the finder, make sure that it is not too near to be in focus, and then snap the shutter.

Probably he will find the shutter marked with variable speeds. Too much reliance should not be placed on the correctness of these, but fortunately strict accuracy is not essential. A shutter speed somewhere near 1/25th second will be found most suitable for ordinary snap-shot work. A longer exposure than this would probably cause a blurred image through movement of the camera, while a shorter one might under-expose the plate or film.

STOPS.

The lens will certainly be supplied with stops. These may take the form of a metal plate pierced with round holes, or it may be that an iris diaphragm working outside the lens, or between its components, is fitted instead. The iris diaphragm consists of a

number of blades of metal opening out to a wide aperture or closing to a very small one by the action of a lever, and it serves the same purposes as the holes in the metal plate already mentioned.

The function of the stops is three-fold :

(1) To increase the depth of definition.

(2) To improve the definition when the lens is not of the highest class.

(3) To reduce the amount of light reaching the plate when the light is unduly bright.

The beginner will soon find that when a near object is in focus distant objects are out of focus, and *vice versa*, but within certain limits all objects will be reasonably sharp. The extent to which the lens brings objects at varying distances into sharp definition is termed its *depth of definition*. When the stop in the lens is of large aperture, the depth of definition will be relatively small ; with a very small stop the depth of definition will be much greater.

The reader will remember that when the swing back is used as explained on page 10, a small stop has to be inserted to increase the depth of definition and compensate for the difference between the distance of the top and bottom of the focussing screen from the lens.

The difficulty of getting the whole of the image equally sharp occurs also when photographing an object with a flat surface, such as a plan or map. With anything but a high-class lens it will be impossible to get the middle and edges equally sharp unless a small stop is inserted in the lens. The usual course is to obtain the best definition possible over the whole of the plate and then stop down until the requisite degree of sharpness is secured, refocussing if necessary.

Obviously the smaller the stop the less light will reach the plate ; and when working in a very bright light—such, for example, as prevails on the sea—the worker may find it desirable to reduce the aperture of the lens so as to avoid over-exposure.

Stops are numbered according to their " F " (focal) value. If we know the focal length of our lens and the diameter of the stop, the " F " value can be calculated by the following simple formula :

F value = Focal length of lens ÷ Diameter of stop.

The F value of a stop $\frac{1}{2}$-inch in diameter used with a 6-inch lens would, therefore, be $6 \div \frac{1}{2} = F/12$.

The extent to which the smaller stops increase exposure is shown by the following table :

Stop ...	F/5·6	F/8	F/11	F/16	F/22	F/32
Relative Exposure ...	1	2	4	8	16	32

The worker with the fixed-focus camera will probably find that his largest stop is F/11, and as a rule he should not try to do snapshot work with a smaller aperture than this.

Rapid rectilinear lenses generally work at F/8, whilst the more expensive anastigmats work at F/6, F/4·5, or even at F/2.

THE LIGHTING OF THE SUBJECT.

At the outset the worker should see that the light comes from the back, preferably to the right or left of the camera. Later he will find that his most pleasing results are obtained when the picture is taken with the light more or less in front. He must, however, always guard against allowing the direct rays of the sun to shine into the lens during exposure, otherwise a wholly or partly fogged plate will result.

JUDGING THE DISTANCE.

With the focussing hand camera, unless the ground-glass screen can be used, the worker has to rely on a correct estimate of the distance of the subject. At first he should measure this, but after a very short time he will find that he can make a sufficiently accurate estimate with the eye alone. His best course will be first to pace out a measured distance. Having thus established the length of his stride, he will be able accurately and unobtrusively to measure

any other distance, and can focus accordingly. This procedure will be necessary only during his earlier experiments, later he will be able to form an accurate appreciation of distance by a mere glance.

TIME EXPOSURES.

The beginner will notice that his shutter allows not only of exposures varying perhaps from $\frac{1}{5}$ to $\frac{1}{100}$ of a second, but also of an exposure the duration of which depends entirely on how long he allows the lens to remain open. Such exposures are termed " time exposures," and when photographing indoors or under the shade of trees time exposures are almost always necessary.

The notes on page 24 should be carefully read, and, aided by a Wellington Exposure Disc or Meter or a Wellington Exposure Table, the worker will not go far astray in estimating what exposure is required.

If difficulty is experienced, or if the beginner is in need of further information, he should write to us at the address given on the title page. Every possible assistance will gladly be rendered.

Wellington Plates.

Wellington Plates are made in fifteen varieties. The following list explains the special purposes for which each plate is intended.

1.—WELLINGTON SPECTRUM PLATE.

This is an extremely fast, fine grain panchromatic plate, practically evenly sensitive to the entire spectrum and remarkably free from mechanical faults.

A chapter devoted to its manipulation will be found on page 42.

The speed of the Spectrum Plate for average white light is H. & D. 450.

It should be remembered that panchromatic plates are more sensitive to red, orange and yellow light than ordinary plates. They, therefore, appear relatively faster as the light tends towards the yellow and orange.

2. ISO WELLINGTON PLATE.

This is the fastest of all the Wellington Plates representing, in fact, the highest achievement in the manufacture of ultra sensitive isochromatic emulsions.

PORTRAIT STUDY

Photograph by Elliott & Fry on an Iso Wellington Plate.
Reproduced from a print on Wellington Press Enammo.

It is an admirable studio plate, yielding superb results by daylight, arc-light or gas-filled lamps. It is equally good for outdoor work and for flashlight photography. The grain is extremely fine and the plate yields negatives of perfect gradation.

The speed is 700 H. & D.

3.—WELLINGTON SUPER 'XTREME PLATE.

This is a non-colour sensitive plate specially manufactured for studio work. The speed is 500 H. & D.

4.—WELLINGTON 'XTREME PLATE.

Except that it is slightly slower, this plate is almost identical with the Super 'Xtreme mentioned above. The speed is 400 H. &. D.

5.—WELLINGTON 'XTRA SPEEDY PLATE.

The Wellington 'Xtra Speedy Plate is slightly slower than the 'Xtreme, but by reason of the readiness with which it gains density is to be preferred for hand-camera work. It gives brilliant negatives, free from hardness and of exceptionally fine grain. The speed is 350 H. & D.

6.—WELLINGTON X PRESS PLATE.

The requirements of the Press photographer differ in many respects from those of the ordinary worker. We have therefore produced for his use a plate embodying many special qualities. The delicacy of gradation demanded by the portrait photographer is out of place in a negative intended for reproduction in a daily paper. What is here needed is detail, good contrast and rich shadows. The Wellington X Press Plate gives

a negative exactly fulfilling these requirements and renders easy the production of satisfactory results under the most adverse conditions. It develops, fixes and dries very rapidly—another great convenience in Press work, where speed of production is such an important factor—and the tough emulsion with which it is coated is well calculated to withstand rough handling in the Press photographer's dark room.

The speed is 500 H. & D.

7.—WELLINGTON ANTI-SCREEN PLATE.

Every photographer knows that an ordinary plate is almost completely insensitive to yellow, green and red. Consequently it renders those colours as black, or nearly so. The introduction of the isochromatic plate somewhat remedied this defect, but the sensitiveness to yellow and green was still so small in proportion to the sensitiveness to blue and violet, that only by the use of a light filter to cut out the greater part of the blue and violet rays was the plate able to show any appreciable improvement in colour rendering. Moreover, the use of a light filter necessitated a considerable increase in the exposure, and therefore the hand-camera worker, whether he used ordinary or isochromatic plates, had still to be content with the old false colour-rendering, in which yellow, the most brilliant colour in nature, was rendered as only a few shades lighter than black.

The Wellington Anti-Screen Plate is an isochromatic plate, but, unlike an ordinary isochromatic plate, is capable of giving an exceedingly fine rendering of the greens and yellows *without the use of a light filter*. In portraits, landscapes and seascapes, in flower studies and in architectural work, the problem of correctly rendering colour is always present, and always the Anti-Screen plate is capable of solving it satisfactorily. When the Anti-Screen plate is used in

portraiture the work of retouching is reduced and a more perfect rendering of the hair and of flesh tones is secured.

It is a characteristic of the Anti-Screen plate that it is almost free from halation, even when used unbacked.

The Anti-Screen plate is only a little slower than the fastest plates made, and is therefore ideal for the hand camera. Provided with the Anti-Screen plate, the photographer is able to deal successfully with almost any subject that may present itself, from a flower study to an aeroplane in flight.

The speed of this plate has recently been increased to 450 H. & D.

8.—WELLINGTON STUDIO ANTI-SCREEN PLATE.

This plate possesses the same general quality as the Anti-Screen plate described above, but is made softer in gradation to meet the requirements of professional photographers.

The speed is 500 H. & D.

9.—WELLINGTON ISO SPEEDY PLATE.

This is an isochromatic plate intended for use with a light filter. Where a high degree of colour correction is not desired, it can, of course, be employed like an ordinary plate without a light filter. The speed is 275 H. & D.

10.—WELLINGTON SPEEDY PLATE.

Where very high speed is not required no better plate could possibly be used than the Wellington Speedy Plate. Originally manufactured for use in the studio, it is equally suitable for general photography both indoors and out.

The Speedy Plate is largely used in tropical countries. The speed is 250 H. & D.

11.—WELLINGTON ORDINARY PLATE.

This is a medium slow plate, very suitable for copying purposes and for the making of enlarged positives and negatives.

The speed is 125 H. & D.

12.—WELLINGTON ORTHO PROCESS PLATE

This plate is specially made for process workers, and will be found excellent both for line and half-tone work. Its orthochromatic properties and extremely fine grain, combined with its density-giving power, make it also of great value to the commercial photographer. For copying documents, blue prints, coloured diagrams, &c., it is, we believe, unequalled.

13.—WELLINGTON CONTRASTY ORTHO PROCESS.

This plate is similar to the Ortho Process but gives greater contrast. The speed is 30 H. & D.

14.—WELLINGTON LANTERN PLATE.

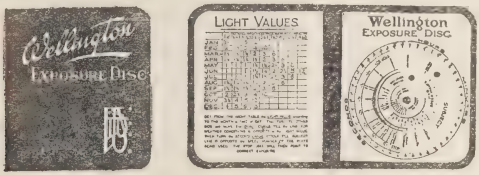
This plate is recommended to those who require a lantern plate of medium speed. It is especially suited to the making of lantern slides by reduction, and may also be used for making enlarged transparencies for window decoration and similar purposes.

Cold black, warm black, brown and sepia tones may be obtained in development, and almost any colour by after-toning.

15.—WELLINGTON S.C.P. LANTERN PLATE.

The S.C.P. Lantern plate is coated with the same emulsion as the Wellington S.C.P., and can therefore be used in ordinary artificial light, a dark-room being quite unnecessary. By reason of its low speed it is especially suited for contact printing, but if a strong light (*e.g.*, daylight) is available it serves equally well for the production of lantern slides by reduction. A special feature of this plate is the exceptional brilliancy of the results obtainable and the fine range of pure tones from black to red which can be produced by simple development.

For the purpose of determining correct exposure the Wellington Exposure Disc or the Wellington Exposure Meter should be used.



The Wellington Exposure Disc is a simple piece of apparatus which determines almost automatically the exposure necessary for any subject, under any condition of light.

The Wellington Exposure Meter is an extremely simple direct vision meter, which can also be used to determine exposures in enlarging.

Exposure & Development of Wellington Plates.

When the photographer opens his first box of plates he will find them packed in pairs face to face, every two pairs being wrapped in brown paper. If the pairs are hinged together by the uncut gelatine film the two plates should be separated by opening them like the leaves of a book and bending them gently backward.

Needless to say the box must never be opened except in the dark-room, because the brown paper in which the plates are wrapped is not in itself sufficient protection against light action.

If only one plate is required the unused plate should be turned so that its film is towards the glass side of the next plate instead of towards the brown wrapping paper, long contact with which might cause the plate to deteriorate.

It is important that the dark-room should be illuminated by a suitable light and that every ray of white light should be excluded. A serviceable dark-room "safe light" may be made by binding together a sheet of red and a sheet of yellow glass, or two sheets of similarly coloured fabric obtainable from photographic dealers may be used in its place. Better still, a specially prepared filter

consisting of stained gelatine protected by two sheets of glass, one being ground glass, may be employed. If the small additional cost is no drawback a filter of this type is much to be preferred. When purchasing such a filter it is desirable to specify whether it is to be used for slow plates, fast plates or isochromatic plates. With a plate like the Wellington Spectrum plate (see page 42) no light whatever is permissible in the dark room, but with the plates described in this chapter it is possible by using a light of the right colour to have the dark-room comfortably illuminated.

In buying a dark-room lantern it is well to pay a fair price rather than to content oneself with a cheap article, which later may cost many times its value in fogged plates.

It should never be forgotten that a good light at a distance of several feet is much better than a weaker light at a few inches from the plate. All light, even the deepest red, will affect a plate in time. Care must, therefore, be taken not to expose the plates unduly during manipulation.

Pieces of stiff card may be used to cover the dishes when developing, and it should be made a rule, especially with very fast plates like the Iso-Wellington and the Anti-Screen, never to expose them to the dark-room light except during the few moments when the progress of development is being noted.

FILLING DARK SLIDES.

When loading the dark slides or camera the safe light must never be allowed to shine directly on to the plates. To avoid this the worker should place himself so that his body intercepts the direct rays of the lamp. The plates will be found packed in pairs, face to face, the sensitive surface of each being turned inwards. They should not be dusted when putting them in the slides, as this only electrifies their surface and attracts dust. When only a few have been taken out of the cardboard box in which they are supplied, the box should be wrapped up before being removed from

the dark-room and should not be relied upon, of itself, to keep the plates within it protected from light.

EXPOSURE.

For hand-camera work, with Anti-Screen plates in the camera, anything that is photographically possible can be secured. When, however, a plate of extremely high speed is needed the Iso-Wellington can be used with absolute confidence.

As a guide to correct exposure, the Wellington Exposure Disc, the Wellington Meter, the Watkins Meter or the Wynne Meter will be found extremely valuable. Full exposure is always to be recommended.

THE DEVELOPER.

Any of the developers on the market will give excellent results with Wellington plates if used in correct proportions and in solutions of suitable strength. Both pyro-soda and metol-hydroquinone will be found very suitable. Pyro-ammonia—although not recommended to the beginner—may be used if preferred. The following Wellington formulæ are recommended :—

PYRO-SODA.*

No. 1.

Pyrogallic Acid	1 ounce	50 grammes
Sodium Sulphite (cryst.) ...	2 ounces	100 „
Citric Acid	40 grains	4·5 „
Water to	10 ounces	500 c.c.

No. 2.

Sodium Carbonate (cryst.) ...	8 ounces	100 grammes
Sodium Sulphite (cryst.) ...	8 „	100 „
Water to	80 „	1 litre

For Normal Work—take 1 ounce (30 c.c.) of No. 2 and 1 dram (4 c.c.) of No. 1, with Water, 1 ounce (30 c.c.).

For Studio Work—take 1 ounce (30 c.c.) of No. 2 and ½ dram (2 c.c. of No. 1, with Water, 1 ounce (30 c.c.).

* *This developer is obtainable in packet form.*

METOL-HYDROQUINONE.*

(Wellington Universal formula suitable for all Wellington Plates, Papers and Films.)

Metol	20 grains	1 gramme
Hydroquinone	60 „	3 grammes
Sodium Sulphite (cryst.) ...	700 „	35 „
Sodium Carbonate (cryst.) ...	700 „	35 „
Potassium Bromide	6 „	0·3 gramme
Water to	20 „	500 c.c.

Dissolve in the order given, allowing each chemical to be in complete solution before adding the next. In well-stoppered bottles this developer keeps almost indefinitely. For use, dilute with an equal quantity of water.

N.B.—All metol-hydroquinone developers should be used at a temperature of from 60° to 65° Fahr. Below 60° Fahr. hydroquinone rapidly loses its developing power, and in very cold solutions becomes practically inert.

PYRO-AMMONIA.

No. 1.

Pyrogallic Acid	1 ounce	50 grammes
Sodium Sulphite (cryst.) ...	2 ounces	100 „
Citric Acid	40 grains	4·5 „
Water to	10 ounces	500 c.c.

No. 2.

Ammonia 880	1 ounce	50 c.c.
Water to	10 ounces	500 c.c.

No. 3.

Ammonium Bromide	1 ounce	50 grammes
Water to	10 ounces	500 c.c.

Take 10 drops of No. 1, 10 drops of No. 2, and 5 drops of No. 3 to each ounce (30 c.c.) of Water.

COMPOUNDING THE DEVELOPER.

In making up the pyro-soda formula the sulphite and citric acid should be allowed to dissolve in from four to five ounces of hot water. When cool the pyro should be added, and the solution diluted with cold water to make 10 ounces in all. It will keep all the better if it is made up with water that has been boiled briskly and allowed to get cold without agitation. The carbonate and sulphite solution can be made with hot water also. Neither must be used until quite cold. In a well-corked bottle, the pyro solution

* *This developer is obtainable in packet form.*

will keep for a couple of months at least, and as long as it shows no more than a slight yellow discoloration may be regarded as in good working order. An old No. 2 solution tends to give yellow negatives.

If preferred potassium metabisulphite may be substituted for citric acid and sodium sulphite as the preservative in the pyro solution. One ounce of metabisulphite should be dissolved in cold or warm—not hot—water, and the pyro added as described above.

Water previously boiled should also be used for mixing the metol-hydroquinone developer. It is important that the metol should be completely dissolved before the other ingredients are added. Metol does not readily dissolve in the presence of sodium sulphite, and any undissolved particles will probably remain in suspension until they become deposited upon the plates during development, giving rise to a plentiful crop of black spots. Warm water is to be preferred for making up the solution.

THE WELLINGTON BORAX-M.Q. DEVELOPER.

For the production of delicate fine-grain negatives the following metol-hydroquinone developer, in which borax replaces the usual alkali, will be found of great value. Its advantages are most marked in the development of very small negatives of the Verascope type, positives from which are generally produced by enlargement or viewed by magnification. It works best with plates which have been fully exposed.

BORAX-M.Q.

Metol	20	grains	1	gramme
Hydroquinone	20	„	1	„
Sodium Sulphite (cryst.) ...	200	„	10	grammes
Borax (powdered)	200	„	10	„
Water (hot)	20	ounces	500	c.c.

Dissolve in the order given, allowing each chemical to be in complete solution before adding the next. This developer keeps almost indefinitely in well-stoppered bottles.

N.B.—All metol-hydroquinone developers should be used at a temperature of from 60° to 65° Fahr. Below 60° Fahr. hydroquinone rapidly loses its developing power, and at very low temperatures becomes practically inert.

DEVELOPING.

The plate should not be soaked in water before developing. The developer should be mixed in a measure with a wide mouth and poured over the plate with an even sweep, not splashed on. With some waters a slight scum rises to the surface of a pyro developer which has been allowed to stand, and this scum when poured over the plate may adhere and give rise to marks for which there will be no remedy. When this is noticed the two solutions must be mixed the moment before use. After developing a plate with pyro-soda the developer should be thrown away. When metol-hydroquinone is used the same solution may be made to serve for two or even more negatives developed in succession, but it must be remembered that with each plate developed the solution loses activity. It is poor economy to save developer at the cost of spoiled plates. During development the dish should be rocked gently, not violently, from time to time, and should be kept covered, except when the plate is being examined.

DEVELOPMENT BY THE WATKINS METHOD.

While the practised photographer will have no trouble in deciding how far to carry development, the beginner will be in considerable doubt, and without some guide may find himself spoiling what might otherwise be good negatives. The Watkins system affords this guidance, and if the exposure has been anything like correct can be relied upon to give good results. To put this method into practice with the "normal" pyro-soda formula given on page 24, the time in seconds is noted between the moment when the developer is poured on the plate and the moment when the first sign of the image appears. The time so taken is multiplied by 10, and the result is the total time, from the commencement, that the plate should remain in the developer. There is no need to hurry over the calculation. Make a note of the time by the watch when the developer is poured on, and as soon as the image begins to

appear, again note the time. The dish is then covered with a card to protect the plate from light, and while development progresses the time at which it will be finished is worked out. When such time is reached the plate is removed from the developer. If the "factor" 10 gives a negative that is more vigorous than is desired, nine or eight may be used in the same way; or *vice versa*, 12 or even 14 may suit some workers. Whatever the method of development, the dish should be gently rocked from time to time.

EXAMPLE.—*If* 30 *seconds elapsed between pouring on the developer and first seeing any sign of the image, development will be complete in* 10 *times* 30 *seconds altogether, that is, in* 300 *seconds, or five minutes.*

A factor of 14 will be found correct with the Wellington M.Q. Universal formula and 10 with the Borax M.Q. formula.

TIME DEVELOPMENT.

Time development, pure and simple, is based on the principle that, with a given make of plate, the time required by a given developer to produce a given type of negative is determined by the temperature.

The following table gives the times required for the production of normal contrast on Wellington Anti-Screen, X Press and 'Xtra Speedy plates. One-fifth longer development should be given to Iso-Wellington, Studio Anti-Screen and Super 'Xtreme Plates.

	60° Fahr.	65° Fahr.	70° Fahr.
Universal M.Q. Developer ...	5	3½	3 mins.
Pyro Soda	5	3½	3 "
Borax-M.Q.	6	5½	4 "

Wellington Plates are admirably adapted for tank development. The following formulæ, which require the same stock solutions as the developers mentioned on pages 24 and 25, are recommended :—

THE BAND OF HOPE

Photograph by F. Neal on a Wellington Anti-Screen Plate.
Reproduced from a print on Wellington Press Enammo.

PYRO-SODA.*

No. 1.

Pyrogallic Acid	1 ounce	50 grammes
Sodium Sulphite (cryst.) ...	2 ounces	100 „
Citric Acid	40 grains	4·5 „
Water to	10 ounces	500 c.c.

No. 2.

Sodium Sulphite (cryst.) ...	8 ounces	100 grammes
Sodium Carbonate (cryst.) ...	8 „	100 „
Water to	80 „	1 litre

The developer is made by taking half an ounce (12·5 c.c.) of No. 1, four ounces (100 c.c.) of No. 2, 20 minims (or drops) of a ten per cent. solution of Potassium Bromide, and diluting to make 40 ounces (1 litre).

TIME AND TEMPERATURE TABLE.

	55° F.	60° F.	65° F.	70° F.
ISO WELLINGTON ...	36	30	26	22 mins.
SUPER 'XTREME	36	30	26	22 „
STUDIO ANTI-SCREEN ...	36	30	26	22 „
'XTREME	35	29	25	21 „
'XTRA SPEEDY	32	26	22	18 „
X PRESS	31	25	21	17 „
ANTI-SCREEN	30	24	20	16 „
ISO SPEEDY	30	24	20	16 „
SPEEDY	27	22	18	14 „
ORDINARY	23	18	14	10 „
ORTHO PROCESS	23	18	14	10 „

METOL-HYDROQUINONE.*

Wellington Universal formula, suitable for all Wellington Plates, Papers and Films.)

Metol	20 grains	1 gramme
Hydroquinone	60 „	3 grammes
Sodium Sulphite (cryst.) ...	700 „	35 „
Sodium Carbonate (cryst.) ...	700 „	35 „
Potassium Bromide	6 „	0·3 gramme
Water to	20 ounces	500 c.c.

The developer is made up by diluting one part of the stock solution with nine parts of water, and adding three drops of a ten per cent. solution of Potassium Bromide to each ten ounces of the dilute solution.

* *This developer is obtainable in packet form.*

TIME AND TEMPERATURE TABLE.

	55° F.	60° F.	65° F.	70° F.	
ISO WELLINGTON	27	23	19	17	mins.
SUPER 'XTREME	27	23	19	17	„
STUDIO ANTI-SCREEN ...	27	23	19	17	„
'XTREME	26	22	18	16	„
'XTRA SPEEDY	24	20	17	15	„
X PRESS	23	19	16	14	„
ANTI-SCREEN	22	18	15	13	„
ISO SPEEDY	22	18	15	13	„
SPEEDY	20	17	14	12	„
ORDINARY	16	13	11	9	„
ORTHO PROCESS	16	13	11	9	„

The times for Spectrum Plates are given on page 45.

The following points require careful attention if plates are to be developed successfully by this system. The developer must be made up accurately, as slight alterations in its composition may considerably alter the time required. The temperature should be taken after mixing and immediately before use. No attempt must be made by the addition of hot or cold water to bring the solution to any particular temperature, as such temperature will not be maintained, unless it happens also to be the temperature of the room. A thermometer, with its scale engraved on the stem or enclosed in the glass, should be used, and should be left in the solution for half a minute or so before the reading is noted. If the temperature is not exactly either of those given in the above table, but something intermediate, an intermediate time should be given.

The time mentioned in each case is that which should elapse between pouring on the developer and putting the plates in hypo, as development does not cease as soon as the developer is poured off and the plates are rinsed, but will be found to continue even when the plates are placed in clean water.

Different workers have different views as to the precise density that their negatives should possess; different printing processes call for differences in contrast, and some classes of subjects are better for being a little softer or stronger than others. Portraits,

for example, are all the better for being thinner than landscapes. The figures given, therefore, must be regarded as approximate. They form a good guide for the beginner, since they at least indicate much more correctly than he could hope to find out by examination, when to stop development. The more advanced worker, who has his own views as to the degree of contrast he should obtain, may wish to develop for a little longer or a little shorter than the time stated, and there is no reason why he should not do so.

Fresh developer should be used for each lot of plates. When pyro is used this is absolutely essential. The developing tank should be reversible. It is important to reverse the tank after the developer has been acting for a minute or two, and to divide the remainder of the time into three or four equal parts, reversing the tank at the end of each period. If this is not done, it may be found that there are streamers of extra density proceeding from the thinner parts of the plates.

FIXING.

When development is finished, the plate should be rinsed for a moment in clean water or under the tap, and then placed in either of the following baths :—

FIXING BATH.

Hypo	4 ounces	100 grammes
Water to	20 „	500 c.c.

ACID FIXING BATH.

Hypo	4 ounces	100 grammes
Potassium Metabisulphite ...	200 grains	13 „
Water to	20 ounces	500 c.c.

If perfectly clean negatives are required, the plate should not be exposed to anything but the red light until fixing is complete, and the hypo bath should be fresh. Fixing should be continued until all the white appearance has gone from the back of the plate, and *for as long again*. The Acid Fixing Bath tends to give cleaner negatives than those obtainable when a plain fixing solution is used.

In temperate climates there is no need to use a hardening bath with Wellington plates. If any difficulty is experienced with frilling or blistering, the reader should study the notes on pages 67 and 68, which apply equally to plates and bromide paper.

WASHING.

The simplest way to wash a single negative is to place it on some support smaller than itself underneath the tap, and let a gentle stream of water flow over the whole surface for half an hour. Several negatives may be washed by hand in flat dishes in the same space of time, by continually changing the water, draining the plate well and rinsing the dish at each change. At least a dozen changes should be given, allowing the plate to remain in each for a couple of minutes. Any good automatic washer can of course be used, and in this the plates will require very little attention.

With most waters, a fine deposit of lime accumulates on the surface of the plate during washing. It does no harm but is unsightly. It is removed by holding the plate film upwards under the tap for a moment when washing is finished and gently rubbing the surface with a piece of wet cotton-wool, taking care, of course, not to scratch the tender surface of the film.

DRYING NEGATIVES.

Negatives dry quickest in a current of dry air. No attempt should be made to dry them by heat. The grooves in most grooved drying racks are much too close together, and at least an inch should be left between each plate in the rack.

Few people varnish their negatives, and for ordinary work on Wellington papers there will be found little need for this operation. Varnishing, however, should be regarded as essential in the case of negatives that are to be kept for a long period or from which many prints are likely to be required.

TEST THE "SAFELIGHT."

When dry, the negative may be submitted to the following test. Placed film downward on a piece of white paper, those parts which were protected by the edges of the sheath or dark slide, and so received no exposure to light in the camera, should show only the faintest grey tint. If the plate was unbacked the edges where they come against the sky are almost sure to be greyed, but the other edges where they border on the landscape, and particularly on shadows, ought to be quite clean. If there is anything like a notable deposit on them—that is to say, if the edges are not nearly clear glass—it is a sign that the plate has been fogged from one or more of the following causes :—

An unsafe dark-room light.

Undue exposure of the plate to the dark-room light during development or when loading the slides. (A light, perfectly safe if used with care, will often cause fog in the hands of a worker who exposes his plates recklessly during manipulation.)

An unsuitable developer.

The use of the developer at too high a temperature. (From 60° to 65° Fahr. is the best temperature for development ; and although Wellington plates will stand warmer solutions than this, it is better to err on the safe side.)

Isochromatic Photography.

Not every photographer is satisfied with the rendering of colours given by ordinary or non-isochromatic plates. Everyone knows that certain colours are said to "photograph light" and others to "photograph dark." Blue, especially a pure blue, will appear very much lighter than it is in reality, while yellow, red, and green will often photograph very much darker than they appear to the eye.

We may have two objects side by side, a red and a blue. No one looking at them could doubt for a moment that the blue was much darker than the red, yet in the photograph the blue may seem much the lighter. In the same way, a person's skin may be smooth, and to the eye may appear very much the same tint all over, yet actually there may be, in fact there often are, faintly visible yellow or reddish freckles; and when such a person is photographed, these freckles—on account of their colour—appear very strongly in the print. Much retouching is necessitated by this peculiarity of ordinary plates. In landscape work, a great deal of the beauty of many pictures is due to the different shades of green in the foliage, and to the masses of white cloud against the deep blue of the sky. An ordinary plate renders the greens too much alike and all of them too dark, while the blue of the sky is rendered no darker, and sometimes even lighter, than the white clouds. In copying paintings, and in the photography of flowers, the same difficulties are met.

All this results from the fact that an ordinary plate is not sensitive to red, is only slightly sensitive to yellow or green, and is quite disproportionately sensitive to blue and to violet.

The emulsion of an isochromatic plate is so made that it is sensitive not only to blue and violet, but also to yellow and green. The sensitiveness to blue and violet, however, still remains disproportionately high, and although an isochromatic plate will always give slightly better colour rendering than an ordinary plate, the full value of its isochromatic property is only secured if a light filter is employed. A light filter is a piece of stained gelatine, usually cemented between two perfectly flat pieces of glass, and generally so mounted that it can be used either in front of or behind the lens as may be most convenient. It may also be placed between the lens combinations, this being an excellent method when a gelatine filter is used and is kept permanently in position. With isochromatic plates a yellowish or greenish yellow filter is generally employed, its function being to absorb some of the blue and violet rays while allowing the yellow and green to act almost in their full

intensity. In this way an approximately true rendering of the subject in monochrome is obtainable. No isochromatic plate, however, will give *absolutely* correct colour rendering. For this purpose a panchromatic plate, such as the Wellington Spectrum plate, must be employed in conjunction with an appropriate light filter. For most purposes, however, the Iso Wellington, the Wellington Anti-Screen or Ortho Process will be found all that can be desired.

LIGHT FILTERS.

The use of a light filter necessarily involves an increase in exposure. For the Iso Wellington, the Anti-Screen and, in fact, all Wellington isochromatic plates the Wellington No. 2 light filter will be found the most suitable, the exposure being increased five times when it is used.

It is sometimes asked if a light filter can be used with an ordinary plate. The answer is that it certainly improves the colour rendering, but only very slightly, and as it cuts off most of the light except the yellow and green, to which ordinary plates are almost insensitive, the exposure becomes extremely long.

It is advisable always to focus after putting the screen in position. The exposure is ascertained as usual and multiplied by the factor for the filter in use. It should be remembered that to obtain the maximum advantage with as little prolongation of exposure as possible, the light filter employed must be adjusted to the plate itself, and its factor, whatever it may be, applies to that plate only. A "five times" light filter with one plate may very well become a "three times" or a "ten times" filter when used with another.

Whenever a light filter is used under-exposure must be avoided.

When developing isochromatic plates a deep red light must, of course, be employed, and owing to their extreme sensitiveness, additional care should be taken to protect them from the direct rays of the lamp.

The Wellington Anti-Screen Plate.

The reader who has perused the notes on pages 18 and 19 will need little additional information regarding the Anti-Screen plate. It will have been seen from the foregoing remarks on Isochromatic Photography that to obtain any appreciable benefit from the use of an ordinary isochromatic plate a light filter must be used, and the exposure increased from two to five times, according to the depth of the filter employed.

The Wellington Anti-Screen plate is an isochromatic plate, but, unlike isochromatic plates generally, it has the power of giving an excellent rendering of the yellows and greens *without the use of a light filter.*

It will therefore be seen that the Anti-Screen plate brings the advantage of isochromatic photography within the reach of the hand-camera worker, who can only rarely afford the long exposure rendered necessary by the use of a light filter. It brings isochromatism also to the help of the portrait photographer, and allows of his securing portraits in which the hair and the texture of the skin are rendered far better than would be possible with an ordinary plate, his negatives in consequence requiring less retouching. What is even more important to the general worker is the fact that with the Anti-Screen plate he is able to deal efficiently with any subject that may present itself.

At the end of the day, when the light begins to grow yellow and an ordinary plate becomes almost useless, the Anti-Screen plate, by reason of its sensitiveness to yellow light, seems to gain in speed, and thus becomes of increased value to the photographer who desires to record the effects of light and shade which are so charming to the eye in the early evening.

Finally, the peculiar character of its coating renders the Anti-Screen plate almost free from halation even when used unbacked.

The Anti-Screen plate is developed exactly as described in the preceding pages.

The speed of this plate has recently been increased to 450 H. & D.

The Wellington Ortho Process Plate.

This plate is specially made for process workers, having an extremely fine grain, great cleanliness, orthochromatic qualities and high resolving power. It is unsurpassed for copying purposes and for all work where a colour-sensitive plate giving great density is required. Its manipulation does not differ from that of the other Wellington plates.

Any of the developers previously mentioned will be found suitable.

The following are recommended where great contrast is required. They should not be used at a temperature below 60° Fahr. :—

HYDROQUINONE.

Hydroquinone	80 grains	5 grammes
Sodium Sulphite (cryst.) ...	1 ounce	30 „
Potassium Hydrate	80 grains	5 „
Potassium Bromide	10 „	0·6 gramme
Water to	20 ounces	500 c.c.

The following two solution formula is quoted from the British Journal of Photography Almanac :—

HYDROQUINONE AND CAUSTIC SODA.

No. 1.

Hydroquinone	160 grains	18 grammes
Soda Sulphite	2 ounces	100 „
Citric Acid	60 grains	7 „
Potassium Bromide	40 „	4·5 „
Water to	20 ounces	1000 c.c.

No. 2.

Caustic Soda (stick)	160 grains	18 grammes
Water to	20 ounces	1000 c.c.

For use take: No. 1—1 ounce, No. 2—1 ounce, Water—2 ounces

HALATION.

Mention has been made in the preceding pages of "halation" and "backed plates." These terms require a little explanation.

The beginner at photography will soon discover that when he photographs subjects in which there are deep shadows and very bright high-lights his negatives show the high-lights spread beyond their proper boundaries and consequently blotting out the details of the surrounding parts. This is particularly noticeable in photographs of interiors in which windows appear, or in the case of landscapes where trees stand out against a bright sky. This spreading of the high-lights is termed "halation."

To prevent this defect, plates may be obtained with the glass side covered with a coating capable of absorbing the light that passes through the film and preventing its reflection. A plate so prepared is called a "backed" plate.

Wellington plates may be had backed with a red transparent medium which is practically invisible in the dark room and allows the progress of development to be watched by transmitted light just as readily as if the plates were unbacked.

This backing should not be sponged off, as is necessary with ordinary opaque backing. The plate should be treated in the usual way, and it will be found that the backing dissolves completely in the developer, which assumes a dark red colour without in any way losing activity. The colour actually protects the plate from any fogging action of the dark-room light.

INTENSIFICATION.

The Wellington Silver Intensifier.

Negatives which are not sufficiently vigorous owing to some error in manipulation, such as over-exposure or under-development, may be greatly improved by the process of intensification.

The film, after fixing and washing, should first be hardened in a bath composed of Formalin 1 part and water 10 parts.

In this bath the negative should be allowed to remain for five minutes, after which it should be rinsed for a few minutes and then placed for exactly one minute in the following bath :—

Potassium Ferricyanide ...	20 grains	2·3 grammes
Potassium Bromide	20 „	2·3 „
Water to	20 ounces	1 litre

This bath, which should never be omitted, has the effect of preventing stains during the process of intensification.

Too long an immersion in this bath causes the image to bleach, which should be avoided if it is desired to retain the original gradation. In the time prescribed there is no apparent change, but the clearing agent has done its work. The negative should now be rinsed for a few minutes and then intensified in the following :—

STOCK SOLUTIONS.

A.

Silver Nitrate	800 grains	91·2 grammes
Distilled water to	20 ounces	1 litre

B.

Ammonium Sulphocyanide ...	1400 grains	160 grammes
Hypo	1400 „	160 „
Water to	20 ounces	1 litre

(Both solutions keep indefinitely.)

Half an ounce of A should be taken and added to half an ounce of B, stirring vigorously with a glass rod. The solution should be quite clear ; if the stirring is omitted it is apt to be turbid. To this solution should be added 1 dram of a 10 per cent. solution of Pyro preserved with Sulphite, and 2 drams of a 10 per cent. solution of Ammonia. The negative should be placed in a chemically clean dish and the silver solution poured over it. In a minute or two the deposition of the silver begins to take place, and as soon as sufficient density has been acquired the negative should be placed in an acid fixing bath until the slight pyro stain is removed. After this bath the negative should be well washed ; during washing it is well to rub the surface of the film with a tuft of cotton wool to remove the slight surface deposit.

It is important that the negative to be intensified should have been thoroughly fixed in a clean fresh hypo bath, and not merely have been left for some indefinite period in a stale or dirty solution of hypo that has been used on other occasions.

If the original negative is flat from over-exposure, greater contrast may be obtained by over-intensification and subsequent reduction with Farmer's Reducer (see below).

THE CHROMIUM INTENSIFIER.

This intensifier is simple in use and is a favourite with many workers. Two solutions are required.

A.

Potassium Bichromate ...	1 ounce	20 grammes
Water to	25 ounces	500 c.c.

B.

Hydrochloric Acid	½ ounce	10 grammes
Water to	25 ounces	500 c.c.

For use, mix equal parts of A and B.

The negative is bleached in the mixture, washed until the yellow bichromate stain has disappeared, and is then darkened in a strong developer containing no bromide. The amidol formula given on page 84, with the bromide omitted, will be found very suitable. If still more density is required the operation may be repeated.

After darkening, the negative should be washed for ten minutes.

REDUCTION.

Negatives which are unduly dense may be reduced in what is known as Farmer's Reducer. This is made as follows :—

Potassium Ferricyanide ...	120 grains	7 grammes
Water to	20 ounces	500 c.c.

A dram or two of this is added just before use to each ounce of ordinary hypo solution. The negative is immersed in the reducer until it is seen to be *nearly* sufficiently reduced in density, and is then well washed. Negatives that have been dried must be well soaked before treatment. During the process of reduction the dish must be steadily rocked.

Panchromatic Photography with the

Spectrum Plate.

It has already been explained that photographic plates of the ordinary type are sensitive principally to blue and violet, and almost insensitive to green, yellow and red. Isochromatic plates, such as the Wellington Anti-Screen and Iso Wellington, are sensitive to green and yellow, but they still remain almost completely insensitive to red.

This lack of sensitiveness to the red is not wholly a disadvantage, because it allows of a red light being used in the dark-room for loading the camera and for development. There are, however, many purposes for which a plate sensitive not only to violet, blue, green and yellow, but also to red, is necessary, or is at least very desirable. Such a plate is called a panchromatic plate.

As a panchromatic plate is sensitive to all rays, even the deepest red, no dark-room light is safe with it, and unless the method of desensitising described on page 46 is adopted, development must be carried out in total darkness. At one time this would have been regarded as a very serious disadvantage, but the modern photographer is relying more and more on time and temperature and less on visual examination for the correct development of

Photograph on an ordinary plate

Photograph on a Wellington Spectrum Plate.
A 3 times Light Filter was used.

MARQUETRY CABINET

Marquetry Cabinet at the Victoria and Albert Museum.
The ground is dark brown, the flowers being yellow and light fawn.
Both negatives were correctly exposed and developed.

his negatives. When, therefore, he changes over to panchromatic plates he only employs perforce a method of working which he has already adopted by choice as being the best and most scientific.

Among panchromatic plates the WELLINGTON SPECTRUM PLATE represents the highest attainable degree of perfection. So perfect is its correction that it is practically evenly sensitive to the entire spectrum. As a consequence it gives surprisingly good colour rendering when used unscreened, and when a light filter is employed the co-efficient (or factor by which the exposure without filter must be multiplied) is smaller than would be the case with a less perfectly sensitised plate.

Manipulation of the Spectrum Plate.

As previously explained, Spectrum plates must be loaded into the dark slides and removed from them in complete darkness.

Two methods of development are at the choice of the worker :

(1) With previous desensitisation.
(2) Without previous desensitisation.

The worker who has been accustomed to judge the density of his negatives by visual examination will probably choose the first-named method, because it allows of development being carried out in a good light.

If the plates are not desensitised development must be carried out in total darkness and the period of development calculated from the tables given on page 45.

The Wellington M.Q. Universal developer will be found the most generally useful. For very soft negatives—and it must be remembered that panchromatic plates tend to give vigour more readily than ordinary plates—the Metol formula given on page 44 is recommended.

The worker should aim at the production of a thin rather than a dense negative.

WELLINGTON UNIVERSAL METOL-HYDROQUINONE.*

Metol	20 grains	1 gramme
Hydroquinone	60 „	3 grammes
Sodium Sulphite (cryst.) ...	700 „	35 „
Sodium Carbonate (cryst.) ...	700 „	35 „
Potassium Bromide	6 „	0·3 gramme
Water to	20 ounces	500 c.c.

For dish development dilute with an equal volume of water.

For tank development dilute 1 part with 9 parts of water and add 3 drops of a 10 per cent. solution of Potassium Bromide to each 10 ounces of dilute solution.

WELLINGTON PYRO-SODA DEVELOPER.*

No. 1.

Pyrogallic Acid	1 ounce	50 grammes
Sodium Sulphite (cryst.) ...	2 ounces	100 „
Citric Acid	40 grains	4·5 „
Water to	10 ounces	500 c.c.

No. 2.

Sodium Carbonate (cryst.) ...	8 ounces	100 grammes
Sodium Sulphite (cryst.) ...	8 „	100 „
Water to	80 „	1 litre

For vigorous negatives take 1 ounce (30 c.c.) of No. 2 and 1 dram (4 c.c. of No. 1, with water 1 ounce (30 c.c.).

For softer negatives, especially in portraiture, take 1 ounce (30 c.c.) of No. 2 and ½ dram (2 c.c.) of No. 1, with water 1 ounce (30 c.c.).

For tank development take ½ ounce (12·5 c.c.) of No. 1, 4 ounces (100 c.c.) of No. 2, 20 minims (or drops) of a 10 per cent. solution of Potassium Bromide and dilute to make 40 ounces (1 litre).

* *These developers are obtainable in packet form.*

METOL DEVELOPER.

For the production of soft negatives.

Metol	75 grains	5 grammes
Sodium Sulphite (cryst.) ...	2 ounces	60 „
Citric Acid	40 grains	2·5 „
Sodium Carbonate (cryst.) ...	2 ounces	60 „
Water to	20 „	500 c.c.

Dissolve in the order named. For use take 1 part Stock Solution and dilute with 4 parts water.

TIMES OF DEVELOPMENT.

DISH DEVELOPMENT.

(Universal M.Q. and Pyro-Soda Formulæ.)

	Studio Portrait. Minutes.	Ordinary Subject. Minutes.	Full Development. Minutes.
55° F.	3	4½	6
60° F.	2½	3	4
65° F.	2	2½	3
70° F.	1½	2	2½

METOL FORMULA.

	Studio Portrait.	Ordinary Subject.
55° F.	8	12
60° F.	6	10
65° F.	5	8
70° F.	3½	6

TANK DEVELOPMENT.

(Universal M.Q. Formula.)

	Studio Portrait. Minutes.	Ordinary Subject. Minutes.	Full Development. Minutes.
55° F.	18	20	24
60° F.	12	16	20
65° F.	10	14	18
70° F.	8	10	12

(Pyro-Soda Formula.)

55° F.	25	30	35
60° F.	20	25	30
65° F.	15	20	25
70° F.	10	12	15

The reader should carefully peruse the notes on tank development on pages 28 to 31.

FIXING BATH.

Hypo	4 ounces	100 grammes
Potassium Metabisulphite	200 grains	13 „
Water to	20 ounces	500 c.c.

Fix for not less than 15 minutes; a little longer will do no harm. Wash for 45 minutes in running water or in twelve changes of 5 minutes each.

DESENSITISING.

There is no doubt that the necessity of developing in darkness has prevented many workers from adopting panchromatic plates. By means of desensitisers it is, however, now possible to develop a panchromatic plate in full yellow light. The plate must be loaded into the dark slide and removed from it in darkness, and still in darkness must be placed into the desensitising solution.

The desensitiser recommended is Pinacryptol Green. This is obtainable in 1 gramme tubes, one of which should be dissolved in 500 c.c. of water (20 ozs.) to form a stock solution. The working solution is made by taking one part of stock solution and adding 19 parts of water. The solution keeps well and may be used over and over again.

The exposed plate is removed from the dark slide in darkness and placed in the desensitiser for one minute, after which development may be carried out in bright yellow light such as that which is used for the development of bromide prints. It is not necessary to wash the plates between desensitising and developing.

Although we do not advise it, the desensitiser may be used in the developer if preferred.

LIGHT FILTERS.

It is usual to use a filter specially adjusted to the panchromatic plate. Wellington Filters are exactly suited to the requirements of the Spectrum plate, but any of the filters given on the following list may be used with success.

The reader who has had no previous experience in the use of light filters may with advantage read the notes on page 35.

It has already been mentioned that a surprisingly good rendering of colour values is obtained on the Spectrum plate without a filter, but for a perfectly accurate rendering a filter is needed.

The choice of a filter depends upon the nature of the subject to be photographed, the character of the result required, and the length of exposure rendered possible by the prevailing conditions.

For general landscape work, a filter similar to the Wellington No. 2 will be found the most useful; for hand camera work the Wellington No. 1 offers the great advantage that its employment involves very little increase in exposure, while for full correction a filter similar to the Wellington No. 3 must be used.

The following are the factors by which the Wellington filters and some of the other best known filters on the market have to be multiplied when used with the Spectrum plates:—

Filter.	Use.	Factor.
Wellington No. 1 ...	Haze correction, cloud rendering	1¼
„ No. 2 ...	Landscape work, general colour correction ...	2
„ No. 3 ...	Full correction	3
Wratten K1 ...	Haze correction, cloud rendering	1½
„ K2 ...	Landscape work, general colour correction ...	2½
„ K3 ...	Full correction	4
„ A ...	Contrast in furniture, &c., photographed indoors	12
„ G ...	Ditto, outdoors	8
Ilford Alpha ...	Haze correction, cloud rendering	1½
„ Beta ...	Landscape work, general colour correction ...	3
„ Gamma ...	Full correction	5

CONTRAST FILTERS AND THEIR USE.

While the Spectrum plate is made specially to give a correct rendering of colour values, it can also be used to accentuate colour contrast and in certain cases to bring out detail more clearly than it appears to the eye.

This result is obtained by using what are known as contrast filters. For example, if we desire to photograph a red pattern on a blue ground we can, by using a Wellington No. 3 filter, obtain a correct colour rendering of the visual brightness of the two colours, but if we desire the red pattern to stand out very strongly *i.e.* if we

wish it to contrast as much as possible with the blue, we should use a red filter so as to absorb the blue rays of the background and prevent them from acting on the plate whilst transmitting the red rays in their entirety. In this way the red pattern would be rendered much lighter and the blue much darker than they appear to the eye. In other words their contrast would be accentuated.

In the same way a red filter is used for cloud studies when it is desired to accentuate the contrast so as to obtain an exaggerated rendering of the cloud forms.

The rule for obtaining maximum contrast is to use a filter of the same colour as that of the portion of the subject required to be rendered in the lightest tone.

Where less violent contrast is required, as for example in photo-micrography, a good rule is to select a complementary filter : thus for blue-stained preparations use a red, for red use a green, and for yellow use a blue filter. For work of this nature the Wellington Micro-filters, obtainable to order, are admirable. A useful hint is to examine the object through a filter visually before actually making the exposure, as a good idea of the contrast to be obtained by the particular filter can be formed in this way.

The Wellington Anti-Screen Roll Film.

While the value of the glass plate is beyond dispute, there are many occasions when the convenience, the lightness and the daylight loading properties of roll films outweigh all other considerations.

In the Wellington Anti-Screen Roll Film, the photographer will find these advantages combined with the high quality of the Anti-Screen Plate. To the serious worker who desires to secure in his film negatives the same standard of excellence which he has been accustomed to obtain in plates, the appeal of this new negative medium is, therefore, very great.

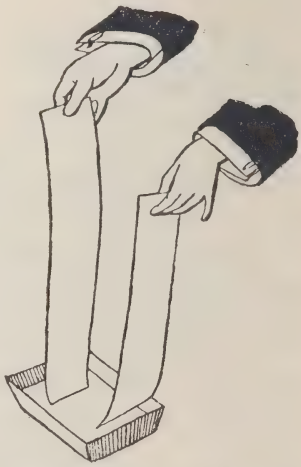
The Wellington Anti-Screen Roll Film requires no special treatment. It can be developed in any of the developers in common use, and is made suitable for development in any of the tanks at present on the market.

DISH DEVELOPMENT.

Many photographers will prefer to develop their films by hand. This is a perfectly simple matter.

A safe dark-room light is essential; one suitable for use with the Anti-Screen Plate will answer perfectly. It should be remembered, however, that in developing films in the length they are exposed to the light for the whole time of development. The lamp, therefore, should be turned down or moved so that it does not shine directly on the film.

The film must first be removed entirely from the red and black paper, and should then be soaked in clean cold water. The simplest method of doing this is shown in the diagram.



Water being placed in a dish, the two ends of the film are held in the two hands, or by means of " bull-dog " clips, which will be found very convenient, and, with the coated surface of the film inwards, the loop of film is passed through the water backwards and forwards by raising one hand and lowering the other.

When the film is quite limp it should be transferred to a dish of developer, and developed in exactly the same manner. While in the developer it should be moved fairly quickly in order to make the development as even as possible.

While any developer may be used, the Pyro-Soda and Metol-Hydroquinone formulæ recommended on pages 24 and 25 for use with Wellington Plates will be found highly suitable.

The times of development will be the same as those given for the Anti-Screen Plate.

TANK DEVELOPMENT.

Beyond all question, the most convenient method of developing a roll film is in one of the many tanks or developing machines on the market. The majority of these render a dark-room wholly unnecessary, so that by printing on Seltona or on Wellington S.C.P. the film user can do the whole of his work from start to finish in an ordinary room.

If the reader will refer to pages 28, 29, 30 and 31, he will find full particulars of the formulæ recommended for tank development, the

THE TUCK SHOP

Photograph by J. B. B. Wellington on a Wellington Anti-Screen Plate.

Reproduced from a print on Wellington Press Enammo.

period of development for the Anti-Screen Film being identical with that recommended for the Anti-Screen Plate.

FIXING.

If the film has been developed in a tank the instructions for fixing issued with the apparatus should be carefully followed. A film which has been developed in the length by hand should be passed several times through a dish of water before fixing.

It should then be placed in a fixing bath consisting of 4 ounces of hypo to 20 ounces of water, to which 200 grains of potassium metabisulphite should be added.

In hot climates the combined hardening and fixing bath recommended on page 67 may be used.

If only a small dish is available the film may be cut up into separate exposures for fixing. The corners should be rounded off to prevent one film from scratching another, and on no account must they be allowed to remain motionless, one on top of the other, in the hypo. They must either be spread out separately or be kept moving, taking the bottom film and placing it on top and so on.

Fixing must be continued until the white appearance has disappeared from the back of the film and for as long again.

WASHING.

When fixing is complete the films should be transferred to the washing water. If the film has not been cut up the two ends should be clipped to opposite sides of a large dish, and the water allowed to flow gently in at one corner, tilting the dish slightly towards the opposite corner so as to ensure a steady current of water throughout the whole length of the film. Films which have been cut up may be washed by transferring them to a dish of clean water, constantly changing the water, draining the films and rinsing the dish between each change. If this is done a dozen times, allowing about half an hour for the operation, the films will be thoroughly washed, provided they have not been allowed to lie on top of one another.

There are other effective methods of washing films. They may be pinned by the edge to a cork and so be floated vertically in a large vessel of water such as an ordinary bath, but they should receive two or three rinsings before being washed in this way to get rid of the greater part of the hypo. Another plan is to pin the film, after one or two rinses, face outwards on a board, curving the film slightly so that the water may get to the back as well as to the front. The board is floated face downwards on the surface of a large vessel of water such as a bath. The water should be changed three or four times.

When the washing is finished the films must be hung up to dry. Wooden clips provide admirable means of hanging them. To prevent curling Wellington Films are coated on the reverse side with gelatine. For this reason neither side must come in contact with anything during drying.

Wellington

Portrait Film.

WELLINGTON Portrait Film consists of a high-grade, fast, isochromatic emulsion coated on specially selected thick celluloid.

Its manipulation differs in no essential detail from that of a glass plate, except that as the back of the film is coated reasonable care must be taken to protect it from injury.

The film should always be handled by the extreme edges. The sensitised side will always be upward if the film is held so that the notch cut in the edge of the film is on the right-hand corner of the top margin.

If the films are to be kept packed together for any period before development the sheets of paper with which they will be found interleaved should be replaced between the exposed films. This interleaving paper should be kept scrupulously clean and dry.

DEVELOPMENT.

Any developer suitable for an ordinary plate or film may be used.

The following formula is recommended owing to its suitability both for Tank and Dish development :—

STOCK SOLUTION A.

Metol	120 grains.	7 grammes.
Hydrokinone	240 „	14 „
Sodium Sulphite (cryst.)	10 ounces.	250 „
Sodium Carbonate (cryst.)...	8 „	200 „
Potassium Bromide	20 grains.	1·25 „
Water to	80 ounces.	2 litres.

STOCK SOLUTION B.

Potassium Metabisulphite	60 grains.	3·5 grammes.
Pyro	1 ounce.	25 „
Water to	10 ounces.	250 c.c.

For Tank development take :—

Stock Solution A	20 ounces.	500 c.c.
„ „ B	½ ounce.	15 „
Water to	160 ounces.	4 litres.

The time of development at 65° Fahr. is from 15 to 20 minutes.

This Solution may be strengthened from time to time by adding 5 ounces (150 c.c.) of A, 1 dram (4 c.c.) of B, with water to 10 ounces (300 c.c.).

For Dish Development take :—

Stock Solution A	3 ounces.	85 c.c.
„ „ B	½ dram.	2 „
Water to	10 ounces.	300 „

The time of development at 65° Fahr. is 5 minutes.

When developing in a dish the film should be slipped smoothly under the solution face up and any air bells removed from the surface by means of a tuft of cotton wool. Use plenty of solution and a dish sufficiently large to allow of handling in comfort.

FIXING.

Fixing may be carried out in a similar manner to that described above, or big dishes may be used and the films placed so as not to overlap one another. In this case no attention during fixing is necessary. An old or stained solution of hypo should not be used, as the backs of the films may become discoloured. An acid bath is recommended.

FIXING SOLUTION.

Hypo	4 ounces.	100 grammes.
Potassium Metabisulphite	200 grains.	13 „
Water	20 ounces.	½ litre.

WASHING.

Washing should be carried out in running water.

Half-an-hour's washing is sufficient provided running water in a large dish is used and the films are kept moving or suspended in a rack.

After washing, lay the films on a sheet of clean glass and gently wipe the back and front with cotton wool soaked in clean water. Then rinse and hang up to dry.

The back of the film as well as the front must be protected from contact with anything whilst drying.

Which is the Best Paper to Use?

The answer to this frequent and somewhat puzzling question depends entirely on the requirements of the worker, and upon the type of negative from which he desires to print.

For winter work, or for those photographers who cannot do their printing in the daytime, papers which can be printed by an exposure of a few seconds to artificial light offer advantages over all others.

There was a time when such papers were incapable of yielding results equal in quality to those obtainable on "print-out" papers; but that day has long passed, and at least nine-tenths of the very best photographs produced at the present time are made on "development" papers, of which Wellington Bromide, Wellington S.C.P., Wellington Mezzotint, and Wellington B.B. are good examples.

WELLINGTON BROMIDE PAPERS.

The Wellington Bromide Papers are coated with an emulsion very similar to that of a slow dry plate, and therefore require a dark room for their manipulation. They are the best papers for the making of enlargements by artificial light, as their speed is such that the exposure is never unduly long. For contact printing they are equally suitable, and the only drawback to their use—if indeed it is a drawback—is that they must be handled in a photographic dark-room.

The Wellington Bromide Papers are manufactured in a wide variety of surfaces, particulars of which will be found on pages 59 and 60, and in two tints, White and Cream. The colour normally obtained in development is a pure black, but by after-toning, as explained on pages 73 to 76, very beautiful sepia tones can be secured. For this purpose the Cream papers are to be preferred, although both White and Cream can be used with success.

For printing on Bromide paper by contact a normal negative is the most suitable. The shadows should not be unduly transparent, nor should the high-lights be over-dense.

WELLINGTON S.C.P.

Wellington S.C.P. (Slow Contact Paper) differs from Bromide paper in being about 60 times slower. The speed has been so adjusted as to allow of the paper being exposed at a few inches from an ordinary gas-jet or electric bulb, and developed in the same room in the shadow of some object so placed as to intercept direct rays. No dark-room is necessary with S.C.P. It is, therefore, a most convenient paper for the amateur, who will find a warm sitting-room more pleasant for this work than a cold dark-room.

A list of the grades of S.C.P. will be found on page 79. It will be noted that there are three distinct kinds—Vigorous, Normal and Soft. Vigorous S.C.P. is intended for use with very thin various negatives. With this grade it is possible to make excellent prints from negatives which would be almost unprintable on any other paper. Normal and Soft S.C.P. are intended for use with normal and vigorous negatives. The colour of an S.C.P. print is a fine rich black.

WELLINGTON MEZZOTINT AND B.B. PAPERS.

Wellington Mezzotint and B.B. Papers are intermediate in speed between Wellington Bromide and S.C.P., but differ from

both in that they give an image of a fine warm black. Prints on these papers suggest a note of distinction which appeals strongly to artistic workers.

They are manipulated in much the same way as the Wellington Bromide papers and require similar negatives. A list of the various grades in which they are made will be found on page 87 and 91.

Wellington Mezzotint Paper, described on page 91, is the latest of these papers.

Its speed is practically the same as that of B.B. paper. It is, therefore, suitable for contact printing and enlarging.

With the special Mezzotint Developer the results obtained closely resemble mezzotints both in colour and in quality.

SELTONA.

For daylight printing Seltona, described on pages 105 to 113, will be found highly suitable. This is a Collodion Self-toning paper, needing fixing in hypo only for the production of beautiful sepia tones. No medium is capable of producing prints of better quality or more artistic colour, yet it is the simplest paper to work.

Seltona has the advantage of giving good results from negatives differing in quality. A negative of medium contrast is, however, the most suitable.

For the amateur, Seltona is beyond question the most suitable paper for contact printing when daylight is available.

WELLINGTON P.O.P.

For those who prefer a print-out paper requiring toning, Wellington P.O.P., made in glossy and matt surfaces, will be found excellent.

DOUBLE-WEIGHT PAPER.

Mention must be made, in conclusion, of the many Thick or Double-weight grades of Bromide, S.C.P., B.B., Mezzotint and Seltona. These papers give fine results when printed with a wide margin and left unmounted. The effect is greatly enhanced when prints are plate marked, for which purpose nothing is more convenient than the Wellington plate markers. Double-weight paper is very suitable for Christmas cards, ball programmes, menus, etc. All paper of this type can be obtained in the form of post-cards.

Wellington

Bromide Papers.

WELLINGTON BROMIDE PAPERS are manufactured in a great variety of surfaces and in six distinct kinds:—PLATINO-MATT, ORDINARY, CARBON, CHAMOIS, CREAM CRAYON and ENAMMO.

Some explanation is necessary to make clear the exact meaning of each of these designations.

The first Bromide paper manufactured possessed a shiny surface—but by no means as glossy as the glossy Bromides manufactured to-day. After a time a demand arose for a perfectly matt paper, similar in appearance to Platinum paper, which had always been noted for its natural, non-glossy surface. To meet this demand manufacturers discovered a means of avoiding the shiny effect, which was until then characteristic of all Bromide papers, and a paper was produced with a matt surface, which was called "PLATINO-MATT" Bromide. To distinguish the older type of paper the latter was termed "ORDINARY." These designations are still used, although the papers themselves have undergone many changes for the better.

PLATINO-MATT BROMIDE PAPERS are manufactured with a matt surface entirely free from sheen. They are supplied in the following grades:—Special Smooth, Smooth and Rough, and Special Smooth (Double weight), Smooth (Double weight), Rough (Double weight), and 'Xtra Rough (Double weight).

ORDINARY BROMIDE PAPERS possess a surface with a very slight sheen. They are made in the following grades:—Smooth, Rough, and Smooth (Double weight).

CARBON BROMIDE is a paper with a rich semi-matt surface resembling a carbon print in general effect. It is made in Single weight and Double weight.

CHAMOIS is the title applied to certain grades of the Wellington Bromide Papers which have been manufactured with a peculiarly delicate surface, suggestive of that possessed by chamois leather. This paper, which is largely used by professional photographers, will take the pencil or brush without special preparation. It is made in seven grades :—Hard White and Hard Cream for soft negatives, Normal White and Normal Cream for normal negatives, and Soft White and Soft Cream for vigorous negatives (all Double weight) and Cream (Single weight) in normal contrast only.

CREAM CRAYON is the title applied to a series of Wellington Bromide Papers manufactured on a cream-tinted base. These are particularly suitable for sepia toning, and are made in Smooth, Rough, and 'Xtra Rough Surfaces, all Double weight.

ENAMMO is the name of those grades of Wellington Bromide which possess a highly glazed surface. These are made in Single and Double weights, and also in a special grade known as Press Enammo, which is largely used in press work owing to the readiness with which it gives bright prints from weak negatives.

A special feature of the Wellington Enammo is its freedom from stress marks.

Enammo Bromide is strongly recommended for making prints from X-ray negatives.

PRINTING ON BROMIDE PAPERS.

Wellington Bromide Paper being sensitive to light is handled as a photographic plate or film, but being much slower than these more light may be used during manipulation. If ordinary artificial light is used, two thicknesses of yellow glass or fabric will render it perfectly safe, while for daylight three thicknesses are sufficient. Such a light allows everything in the dark room to be seen with comfort after a few minutes.

A packet of Bromide paper taken into the dark-room and opened will be found to contain a number of sheets of paper rather stiffer than might be expected when their thickness is taken into consideration. They also have a very slight tendency to curl. This is not enought to cause inconvenience, but is useful as indicating the sensitive side. The stiffness is due to the fact that the paper is coated on one side with a gelatine emulsion containing Silver Bromide, and the curling always takes place with the coated side *inside*—in other words, the concave side or surface of a piece of Bromide paper is the sensitive side; the convex is the back.

There are two ways of printing upon Bromide paper, namely, by contact and by enlargement. Contact printing is the method adopted when the prints are to be the same size as the negative itself; enlarging, when larger prints are required.

Any printing frame can be used for contact printing. Only one of the needful size is wanted, as the exposure is very short, and it is not advisable to try to expose more than one print at a time.

The frame is taken into the dark-room, the negative put into it and dusted, and then, in the yellow light only, the packet of Bromide paper is opened, and a sheet taken out and laid with its sensitive side in contact with the gelatine side of the negative. The back of the printing frame is put in and fastened, and the rest of the paper is wrapped up safely again. In handling Bromide paper care must be taken not to touch the sensitive surface with moist or dirty fingers, or it will most certainly be marked. If the paper is not of the required size, it should be cut with a pair of scissors, and not folded and torn, as this also may lead to marks upon it.

EXPOSURE.

The rapidity of Bromide paper is such that artificial light should always be used for printing, and exposure as far as possible should always be made to the same light. By attention to this point it is possible, and indeed quite easy, having once found what

exposure a negative requires, to make as many prints as may be wanted, either all at one attempt or at intervals of months apart, *without wasting a single piece of paper through under- or over-printing.*

The printing frame should always be placed at a definite distance from the light. It is easy to make a mark on the table or wall at say 36 inches from the source of light, or to tie a piece of string to the lamp with a knot at 36 inches from the bulb. With an average negative, the following list of exposures with various illuminants may be taken as an approximate guide :—

To a 32 c.p. gas-filled electric lamp	4 seconds.
To a duplex paraffin lamp with clear glass chimney	20 ,,
To an incandescent gas burner in good order ...	8 ,,

As the term " average negative " is a very loose description, one or two trials will have to be made. For this purpose a sheet of paper may be cut into three or four pieces, different exposures given to each and marked on them in pencil, all the pieces being then developed together. Alternatively a strip of paper may receive three different exposures in steps. One such experiment should be quite sufficient to give the beginner at Bromide printing a clear idea as to the exposure required.

DEVELOPING THE PRINT.

This, of course, must be done in the dark-room. The exposed paper is taken from the printing frame, or, if an enlargement, from the enlarging apparatus—both contact prints and enlargements are from this stage onwards treated in the same way—and laid face upwards in a clean dish.

If the prints are small ones, say, up to and including 10 × 8 inches, the developer may be poured straight on without first soaking the paper in water. For larger sizes it is better to allow the print to soak for a minute in clean water, to pour this off and drain for a moment, and then to pour on the developer. While in the water the print should be examined to see that it is wetted all over, and that there are no air bubbles clinging to its surface.

This preliminary wetting is intended to prevent air bubbles, which, if occurring during development, produce small white spots. With large sizes it is a good plan to rub the surface gently with a tuft of cotton wool as soon as the developer is applied, but with small prints it is better to see that they are evenly covered with developer, and not to meddle further with them.

When a little experience has been gained the worker will find it better to immerse his prints directly in the developer, instead of pouring the developer over them. The operation is not at all difficult, and as the developer is not poured to and from the measure for each print, oxidation takes place less rapidly and the solution can be used for a greater number of prints than would otherwise be possible. A sufficient quantity of solution should be poured into the dish and the print simply slid under the surface of the liquid. While doing so the dish should be tilted, and when the print is immersed tilted back again so as to send a wave of solution over the paper.

During development the dish must be rocked gently, to keep the liquid moving over the surface of the print. If the exposure has been correct, the image will make its appearance in a few seconds, the actual time depending upon the strength of the developer and its temperature. Over-exposure causes the image to appear very quickly; with under-exposure the picture is very slow in appearing and will lack strength. In these respects Bromide paper resembles the ordinary plate used for making negatives, and anyone who has developed a few negatives will have no difficulty, when taking up Bromide printing, in recognizing at a glance under- or over-exposure.

The same developer may be used for six or more prints in succession, but it should be thrown away when it becomes slow in action and a fresh lot taken, otherwise the prints will assume a greenish tone.

No attempt must be made in developing prints to correct errors in exposure. The procedure described above should be adhered to, and if the exposure is wrong, then another print must be made.

If the exposure is right, development will be complete in about two minutes. With good negatives and *correct exposure* there is little likelihood of over-development, as at the right stage the action of the developer seems to stop almost entirely. This is especially the case with amidol. This stoppage of development may be taken as an indication that the process is finished, but should not be relied on to the extent of leaving the print in the developer too long, or the whites of the picture will be degraded.

When the print is judged to be fully developed it may be placed straight in the fixing bath without washing, but a rinse of a few seconds is desirable.

It is well to mention here that a Bromide print always looks brighter and richer after fixation than it does when it leaves the developer. The finished print, however, will appear darker in the subdued light of the dark-room than in daylight. The beginner should, therefore, fix his test prints and examine them in ordinary light, bearing in mind that a slight darkening will always be noticeable on drying. The print when wet should appear just a shade too light.

DEVELOPERS.

We recommend the following metol-hydroquinone and amidol formulæ, but any developer suitable for Bromide work may be employed successfully with the Wellington papers.

METOL-HYDROQUINONE DEVELOPER.*

(Wellington Universal formula suitable for all Plates, Papers and Films.)

Metol	20 grains.	1 gramme.
Hydroquinone	60 „	3 grammes.
Sodium Sulphite (cryst.) ...	700 „	35 „
Sodium Carbonate (cryst.) ...	700 „	35 „
Potassium Bromide	6 „	0·3 gramme.
Water to	20 ounces.	500 c.c.

First dissolve the metol in water, then the other ingredients in the order named. For use dilute with an equal volume of water.

N.B.—All metol-hydroquinone developers should be used at a temperature of from 60° to 65° Fahr. Below 60° Fahr. hydroquinone rapidly loses its developing power and at very low temperatures becomes practically inert.

* *This Developer is obtainable in packet form.*

AMIDOL (DIAMIDOPHENOL) DEVELOPER.

Sodium Sulphite (cryst.) ...	650 grains.	40 grammes.
Amidol (Diamidophenol) ...	50 „	3 „
Potassium Bromide	10 „	0·6 gramme.
Water to	20 ounces.	500 c.c.

The sodium sulphite must be dissolved first.

It is often recommended to keep a stock solution of sodium sulphite by itself, and to take some of this when wanted and add the amidol. *Long experience shows that this will not do,* as amidol when used with stale sulphite solution develops very slowly, and there is a great loss of brilliancy in the resulting prints—a result for which the manufacturer often gets the blame. The developer given above should therefore be prepared as directed and used within three days of mixing.

The Borax-M.Q. formula given on page 26 will also be found very suitable for use with the Wellington Bromides. It gives rather less contrast than the formulæ mentioned above.

It should be remembered that with any developer the print becomes flatter and inclined to a brownish or greenish colour the more bromide there is present in the solution. A weak developer with a full exposure yields a soft and grey result. Vigorous images with good, rich blacks can only be obtained by giving a short, but sufficient exposure, and developing with a strong, slightly restrained developer, such as those given above.

It is not a good plan to soak the prints in water after developing and before fixing them, as the developer goes on acting to a certain extent, and prints so treated will be found to be less brilliant and to have a slight greyish veil in the lighter parts.

FIXING AND WASHING BROMIDE PRINTS.

The fixing bath recommended is made up as follows:—

Hypo	4 ounces.	100 grammes.
Water to	20 „	500 c.c.

If preferred the following acid hypo bath may be employed:—

ACID FIXING BATH.

Hypo	4 ounces.	100 grammes.
Potassium Metabisulphite ...	200 grains.	13 „
Water to	20 ounces.	500 c.c.

There are other methods of making up an acid fixing bath, but none more simple or more effective than the above. The water may be warmed to make solution take place more quickly, but it must not be hot, or the potassium metabisulphite will have its power greatly reduced. The bath must, of course, not be employed until quite cold. This hypo bath does not discolour, as is the case with a plain hypo solution ; it should, however, not be kept from day to day. Proper fixing is essential, both for the purity of the prints and to ensure their permanence.

In either of the above baths fixation will be complete in about ten minutes, provided the prints are not allowed to cling together. At intervals, and especially during the first few moments after immersion, they should be moved about.

In cases where many prints are being made it is an excellent plan to use two fixing baths, giving the prints an immersion of five minutes in each. When the first bath begins to show signs of discoloration or exhaustion it should be discarded and the second bath should take its place, a fresh bath being used for the final period of fixation.

There is rarely any need to use a hardening bath with the Wellington Bromides. If blistering or softening of the film occurs the cause should be looked for in the manipulation. It should be made a rule to use all the solutions at approximately the same temperature, and never above 65° Fahr. Great difference in temperature between the various solutions, or between the solutions and the washing water, will sometimes—though by no means always—cause blisters to appear.

It is well to remember in this connection that when hypo is dissolved in water a great fall takes place in the temperature of the solution ; indeed, in winter crystals of ice may sometimes be seen to form on the outside of the containing vessel. If, therefore, hypo has to be prepared for immediate use, warm water should be employed, the dissolving of the hypo being sufficient to cool the solution. A better plan is to prepare the hypo well in advance. Any quantity may be so prepared.

WINTER

Photograph by H. W. Hall on a Wellington Anti-Screen Roll Film.
Reproduced from a print on Wellington Bromoil Paper.

The strength of the hypo solution should never exceed that given on page 65. A strong solution is less efficient than one of proper strength, and blistering is liable to follow its use.

During washing, a stream of water should on no account be allowed to fall violently on the prints, otherwise the film may be bruised and blisters will result. A gently flowing stream is equally effective and much safer.

In hot climates, and even in temperate climates where the water supply is exceptionally soft, the use of a hardening bath may be found necessary. The following is a satisfactory formula :—

HARDENING BATH.

Alum	1 ounce.	25 grammes.
Water to	20 ounces.	500 c.c.

The prints should be well rinsed after fixing, and then placed in the above solution for ten minutes, after which they should again be washed.

Most workers will prefer a combined fixing and hardening bath, and provided this is properly prepared and not used for an undue number of prints there is no objection to its employment. The following formula is recommended :—

COMBINED HARDENING AND FIXING BATH.

Hypo	4 ounces.	200 grammes.
Potassium Metabisulphite ...	120 grains.	15 „
Chrome Alum	200 „	20 „
Water to	20 ounces.	1 litre.

The hypo and metabisulphite should be dissolved in one half of the water and the alum in the other. The two solutions should then be mixed.

This bath fixes the print, and at the same time toughens the film to such a degree that it can be washed in warm water, and if necessary dried by heat.

The following points should receive attention :—

The same dish should not be used for developing and fixing.

On no account should hypo be allowed to contaminate the developer.

If the hypo solution is splashed on to the Bromide paper, or transferred to it from the clothes of the worker, at any stage before fixation, stains will result.

The print must not be exposed to any light except that of the dark-room until fixation is complete.

To ensure complete fixation the prints should be immersed face downwards · they should on no account be allowed to float on the hypo bath, otherwise discoloration is liable to occur.

A fixed print which is allowed to float film upwards on the hypo bath for a considerable period will begin to bleach, and in time the image will almost disappear.

After the prints are fixed they must be washed. Many people pay little attention to the sufficient fixing of the prints, and devote a great deal of time to washing them. The reverse is better, although neither process should be neglected. Prolonged washing is a mistake ; what is required is to eliminate the hypo as quickly as possible. For this there is nothing like running water, and many washers are made in which prints can be washed without requiring much attention. If the washing is to be done in a dish, then what has been said about fixing applies with equal force to washing. The prints must not be allowed to overlap unless they are kept in continual motion. Consequently for small prints, if there are many of them, a big basin will be found more suitable than the flat photographic dish.

A washer, which works admirably, can be extemporized out of any big basin and a piece of thin muslin or net. The prints are placed in the basin, which is stood on the middle of the muslin in the sink. The muslin is then drawn up all round till it fits the edge of the basin and is tied over the mouth of the tap. A little arrangement will show how a small stream from the tap should fall so as to give a constant circulation to the water, and thus keep the prints separate and moving. The muslin allows the water to flow away, but prevents the prints from washing out of the vessel.

Washing performed in basins or dishes in which the overflow is from the top must be done with the water constantly in motion ; otherwise the hypo solution sinks to the bottom and does not flow away. If the water flows out of a hole or syphon at the bottom of the vessel, as in most of the ready-made washers, so much motion need not be given to the water, because the hypo solution passes away more easily. Whichever plan is adopted washing will be finished in 30 minutes, provided the water has been running all the time, or, in the case of hand washing, has been constantly changed, the prints being drained and the dish rinsed between each change.

DRYING, TRIMMING AND MOUNTING BROMIDE PRINTS.

When the washing is finished, the prints must be taken out one at a time and then dried. The simplest way of drying, if a few small ones only have to be dealt with, is to mop off the superfluous moisture from back and front with good photographic blotting-paper or a clean cloth, and then to lay them face upwards on a clean towel, drying net or a sheet of pure photographic blotting-paper. Prints must not be allowed to dry between blotting-paper as their gelatine surfaces will stick to the paper.

Large prints are most conveniently and effectively dried by hanging them from one corner by means of clips attached to a line. A number of small prints can be dealt with by running a pin through one corner of each and sticking it into the edge of a shelf, or into a piece of wood supported at its ends, so that the prints hang with each side exposed to the air.

The room in which prints are dried should be free from dust or fluff, and no attempt should be made to dry prints by heat, unless they have been previously hardened.

Bromide prints are best mounted by the dry-mounting process, but most amateur workers will prefer to use a good photographic mountant. This should be evenly applied to the back of the print

with a stiff brush. The print should then be laid on the mount, and a clean piece of smooth paper laid over the surface and the print rubbed firmly into contact with the mount.

It is a good plan, when applying the mountant, to lay the print on an old catalogue or discarded magazine, the pages of which may be turned over as they become soiled with paste. As a general rule it is better to mount prints without previously soaking them in water, as a print saturated with moisture is liable to make the mount cockle. With large prints and stiff mounts, however, there is sometimes an advantage in soaking the print with water and blotting it off before applying the mountant.

With thick Bromide papers a very nice effect can be obtained by dispensing altogether with a mount, and masking the negative so as to give a print with a white margin. If unmounted prints are wanted perfectly flat, they can be made so by putting them aside under pressure for a day or two. When only a few are to be flattened, a very good way is to put a piece of stout glass in a printing frame, insert the prints, fasten the back, and leave them like this until they are wanted. They will come out quite smooth and flat.

Another very efficient method of flattening prints is the following : Hold the print face down on a smooth surface—a chamois leather cushion stuffed with cotton-wool or a sheet of glass answers excellently. A blunt straight edge is then placed upon one edge of the print and drawn firmly across. This process removes all cockle and leaves the print with a slight tendence to curl backward.

Prints may be vignetted on one corner of a piece of paper and the rest printed for the purpose of a menu, a Christmas card, or a postcard. In fact, there are numerous ways in which thick papers may be employed, many of which will no doubt suggest themselves to the reader.

A particularly effective method of finishing Bromide prints is to frame them in the *passe-partout* style. A piece of glass and a stout strawboard are cut to the size of the picture. The latter

is then placed between the glass (which should previously have been thoroughly cleaned) and the strawboard backing, and the whole tightly bound together with narrow strips of gummed paper as a lantern slide is bound. If the picture has been multiple mounted a gummed paper edging may be selected to harmonize with the tints of the mounting papers.

Rings for hanging may be fastened to the strawboard backing by means of tape loops passed through slots in the strawboard and the ends glued before binding up.

GLOSSY SURFACE BROMIDE PRINTS.

If a highly glazed surface is required, the "Enammo" paper must be used. The gloss on this can be increased by drying the prints on glass, ferrotype or specially manufactured glazing plates, in the following manner :—

A waxing solution is prepared by dissolving 60 grains of beeswax cut up into shreds in 10 ounces of benzol (4 grammes in 300 c.c.). This should be shaken at intervals for a day or so, and then the clear solution of wax poured off into a well-corked bottle for use.

The clean glass or ferrotype plates should be rubbed over with a little of this solution on a rag or tuft of cotton-wool, and then polished with a clean cloth. If preferred, French chalk (talc) may be substituted for the glazing solution mentioned above. The talc is dusted over the well-cleaned plate, rubbed in with a piece of cotton-wool, and the surplus powder lightly polished off. The wet prints are then laid on the plate face downwards, squeegeed into contact, and allowed to get thoroughly dry before being removed.

On no account must any attempt be made to dry by excessive heat, or a peculiar mottling will result, and it may be difficult to remove the print from the ferrotype. While there should be no difficulty about stripping the prints, some workers experience trouble in this respect. This can often be prevented by first drying the prints, and then rewetting and squeegeeing as previously described.

A very excellent preventive of sticking is the use of a glazing solution which can be obtained from any photographic dealer. If preferred, the worker may prepare this himself in accordance with the following formula :—

OX-GALL FOR GLAZING.

Prepared Ox-gall	¼ ounce.	6 grammes.
Formalin	2 drams.	6 c.c.
Water	20 ounces.	500 „

Soak the prints in this solution for three minutes, and then without intermediate washing apply them to the glazing slab.

It should be remembered that the above process is necessary only when a very high glaze is required. The normal surface of the paper is quite glossy enough for all ordinary purposes.

Wellington Enammo is entirely free from stress marks.

TONING BROMIDE PRINTS.

Prints on Wellington Bromide paper will yield particularly fine colours if toned as described below.

If the "Sulphide" or the "Hot Hypo and Alum" bath is used, the toned image may be regarded as equal in permanence to that obtained by any photographic process.

The Cream Crayon and Cream Chamois grades are, perhaps, the most suitable, as the cream tint of the paper harmonizes particularly well with the sepia image. The effect obtained with these papers is exceedingly mellow and artistic, but any of the other grades may be used with success, and are indeed preferred by some workers.

THE SULPHIDE PROCESS.

Prints for toning by the Sulphide process should be correctly exposed and allowed to remain in the developer until the action of the solution is seen to stop, which, with the formulæ previously given, will occur in about two minutes. Prints which have been over-exposed and then developed for a brief period will often appear fairly satisfactory in the black-and-white stage, but will give an unpleasant yellow tone in the sulphide bath.

Fixing and washing must be thorough. Imperfect fixing will result in the appearance of dark stains after immersion in the sulphide bath, and imperfect washing will give rise to patches which refuse to darken in the sulphide, but remain a pale yellow colour.

The following stock solutions are required for toning :—

No. 1.

Potassium Ferricyanide ...	400 grains.	45 grammes.
Potassium Bromide	600 „	65 „
Water to	10 ounces.	500 c.c.

This solution keeps almost indefinitely if protected from the action of light.

No. 2.

Sodium Sulphide (pure) ...	1 ounce.	30 grammes.
Water to	10 ounces.	300 c.c.

This solution will keep for a few months only.

To tone the print it is immersed in :—

Stock solution of Ferricyanide and Bromide	1 ounce.	50 c.c.
Water to	10 ounces.	500 „

In this the image will almost disappear in something under five minutes. The print should be left in the solution until there is no doubt that the action has gone as far as it will, and must then, after a wash of about five minutes, be immersed in :—

Stock solution of Sodium Sulphide	½ ounce.	25 c.c.
Water to	10 ounces.	500 „

In this the print gradually redevelops to a fine sepia colour. It should be left until there is no doubt that the action of the solution is complete, after which it should be washed in several changes, or in running water for a quarter of an hour.

If a warmer sepia tone is required than that which is obtained by bleaching and redeveloping in the solutions given above, a small quantity of a 10 per cent. solution of potassium iodide may be added to the sulphide, say, one dram to each pint of the dilute solution.

The sulphide solution must on no account be stronger than that already given, or there will be a risk of the print blistering.

The finished print, after toning, may be mounted on a stout card, and "encaustic paste," or a solution of wax in turpentine, well rubbed into the surface, the surplus being wiped off. This inparts great richness to the print, and is particularly suitable for enlargements which are to be framed up close. Pictures so made cannot be distinguished either in colour or quality from the best sepia carbon prints.

The following is a suitable formula for the Encaustic Paste :—

Purified Beeswax	500 grains.
Oil of Lavender	300 „
Benzol	300 „
Gum elemi	10 „

If desired, the sulphide-toned image may be retoned to a rich red colour by immersion in the following bath :—

Ammonium Sulphocyanide...	100 grains.	10 grammes.
Gold Chloride	10 „	1 gramme.
Water to	10 ounces.	500 c.c.

After toning, wash for ten minutes in running water or several changes.

THE HOT HYPO AND ALUM TONING BATH.

For sepia tones the Hot Hypo and Alum Toning Bath can, if preferred, be used in place of the method described in the preceding pages. A stock solution is made by dissolving 10 ounces of Hypo in 70 ounces of water heated to 135° Fahr., and when all is in solution adding two ounces of Alum little by little. A whitish liquid results. This will keep indefinitely ; it should not be filtered, nor thrown away after use, as the older it is the better it works. In proportion as the volume is reduced by evaporation it should be replenished with new stock solution.

Before using a new bath, it should be "ripened" by immersing waste prints in the solution and raising the temperature to 140°

Fahr., allowing the solution to cool, and then raising the temperature again to 140° Fahr., and again allowing it to cool. Or a small quantity of Nitrate of Silver (about 20 grains) previously dissolved in one ounce of distilled water may be employed as the " ripening " agent, and added to the stock toning solution. If this " ripening " is omitted with a new bath the more delicate tones of the prints may become reduced.

To tone the prints, they are placed face downwards in an enamelled iron dish, and enough of the cold toning solution added to cover them completely. The dish is placed over a gas stove or spirit lamp, and the liquid gradually heated to 120° Fahr., and kept at that point until toning is complete. The prints are them taken out of the toning bath, rinsed in warm water, washed in cold water and hung up to dry.

It is advisable to use a combined hardening and fixing bath for prints intended for toning in the Hot Hypo and Alum Bath, and if the prints appear slightly darker than would seem desirable, so much the better, as slight reduction takes place in toning.

TONING WITH COPPER AND IRON.

Very pleasant colours ranging from a warm black to a bright crimson can be obtained by what is known as Ferguson's process. Three stock solutions are required.

A.	Neutral Potassium Citrate	4 ounces.	100 grammes.
	Water to	40 „	1 litre.
B.	Potassium Ferricyanide	1 ounce.	25 grammes.
	Water to	10 ounces.	250 c.c.
C.	Copper Sulphate. ...	1 ounce.	25 grammes.
	Water to	10 ounces.	250 c.c.

Five ounces of A are taken and to this are added half an ounce of B and half an ounce of C (in metric measures, 100 c.c. of A, 10 c.c. of B, and 10 c.c. of C). The print, after it has been fixed and well washed, is dried or not, whichever is more convenient. If dry it is soaked in water till it becomes limp. The wet print is then

placed in the toning bath, and watched. It will be seen to commence to change colour at once, passing from black to warm black, brown, chocolate, and finally red. When it reaches whatever colour is desired, it is taken out, washed for ten minutes in several changes of water, and then dried.

Blue tones can be obtained by toning with iron. In this case, besides the solution B mentioned above, the following will be required —

D. Ferric Ammonium Citrate	½ ounce.	10 grammes.
Water to	10 ounces.	200 c.c.

The actual toning solution is made by mixing—

B.	1 ounce.	30 c.c.
D.	1 „	30 „
Nitric Acid	½ dram.	2 „
Water to	10 ounces.	300 „

The prints are toned in this exactly as described above, and after toning should be washed for ten minutes or a quarter of an hour. In this process if the whites of the print are not clear by the time the washing is ordinarily finished, it may be continued until they are seen to be clear, always remembering that if the washing is too prolonged the print will be weakened.

There seems to be little doubt that these last two processes leave the print less permanent than if untoned or sulphur toned. It is well, therefore, if permanence is required, to stick to the untoned prints, or to sulphur toning. Still, as these processes are often used, they are given here for what they are worth.

CLEARING AND REDUCING BROMIDE PRINTS.

It is sometimes necessary to clear or brighten a Bromide print. Surface markings or yellow stains due to some defect in the manipulation may be present, or slight fogging may have occurred. In such cases the following bath will be found of great service. It should be applied after fixing and washing, the prints

being immersed until the desired clearing has taken place, and then removed and well washed.

CLEARING SOLUTION.

Thiocarbamide	20 grains.	2 grammes.
Citric Acid	10 „	1 gramme.
Water to	10 ounces.	400 c.c.

This bath will not work unless all traces of hypo have been removed from the print.

BRIGHT PRINTS FROM VERY WEAK NEGATIVES.

Every photographer at some time or another will find himself with a very thin, weak negative, which will not by any ordinary method give him a bright and vigorous print. The following method will be found to do so when every other means have failed :—

A piece of Bromide paper is exposed in the usual way, and then developed for as long as there seems to be any increase whatever in depth, any discoloration of the high-lights being ignored. It must in fact be over-developed. After fixing and washing it is immersed in the following reducing solution until it is seen to be considerably lighter. It is then removed at once to clean hypo for a few minutes, washed and dried. If it is still not light enough the reduction may be repeated, until it is clear that any further action will make the deepest shadows grey instead of black. In this way a good print may often be obtained from a negative otherwise quite useless.

REDUCING BATH.

Potassium Iodide	30 grains.	2 grammes.
Water to	10 ounces.	300 c.c.
Iodine	3 grains.	0·2 gramme.

In this bath the whites of the print will assume a dark-blue tint, owing to the formation of iodide of starch due to the sizing of the paper ; this disappears immediately upon placing the print in the hypo solution.

This reducing bath, if diluted, may be employed for clearing prints in place of the thiocarbamide solution given on the previous

page. The prints, after a short immersion, should be transferred to hypo for five minutes and then washed.

LINE DRAWINGS IN PEN AND INK.

Bromide paper will be found very handy for this purpose. If we have a negative of some subject from which we wish to make a line drawing in pen and ink, we first make a Bromide print which, after fixing and washing, must be well hardened in an alum bath (made by dissolving an ounce of alum in a pint of hot water). It is washed again and dried. This print is then gone over with a pen, using the indelible Indian ink, sold at most artists' material shops for the use of draughtsmen. The line drawing is made on the surface of the print with this ink, and then, when dry, the whole of the silver image is removed, either by the action of the reducer just described and hypo, or by the following bath, which will of itself entirely remove the image in from a quarter to half an hour, leaving the line drawing untouched.

Thiocarbamide	120 grains.	8 grammes.
Nitric Acid	2 drams.	8 c.c.
Water to	10 ounces.	300 c.c.

ENLARGING ON BROMIDE PAPER.

The process of enlarging on Bromide Paper is dealt with on pages 93 to 104.

BLOODHOUNDS

Photograph by Charles Reid on a Wellington Anti-Screen Plate.
Reproduced from a print on Wellington Press Enammo.

Wellington

S.C.P. Gaslight Paper.

THE letters S.C.P., by which this paper is universally known, stand for "Slow Contact Paper." This title was applied because the paper is very much slower, or less sensitive, than ordinary Bromide paper, and therefore especially suitable for making prints by contact.

S.C.P. is made in the following grades :—

For use with weak negatives.

VIGOROUS ART ...	...	Semi-Matt Surface.
VIGOROUS MATT ...	...	Smooth Matt Surface.
VIGOROUS GLOSSY	...	Enamelled Surface.

For use with normal negatives.

NORMAL ART ...	...	Semi-Matt Surface.
NORMAL MATT ...	...	Smooth Matt Surface.
NORMAL GLOSSY	...	Enamelled Surface.

For use with all vigorous negatives.

SOFT ART ...	...	Semi-Matt Surface.
SOFT MATT ...	...	Smooth Matt Surface.
SOFT GLOSSY ...	...	Enamelled Surface.

Negatives too weak to give satisfactory prints in any other process will often give perfect results on Vigorous S.C.P.

All grades of S.C.P. are obtainable in the form of postcards.

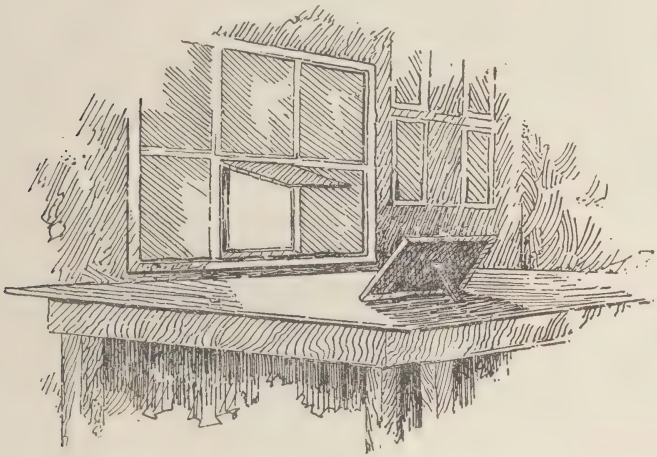
PRINTING ON S.C.P.

The great popularity of Wellington S.C.P. may be traced to the exceptional beauty of the prints obtainable, and the ease and comfort under which they are produced. While ordinary Bromide paper calls for a dark-room, and P.O.P. requires daylight, S.C.P. dispenses with both. All the operations can be performed in a room illuminated with ordinary artificial light, the speed of the paper having been so adjusted that while such light is sufficient to allow of the paper being printed at a distance of a few inches from the light, by retiring a few feet development may be carried out without any risk of fogging. As the light of the room is sufficient for printing purposes, common sense shows that if clean, bright prints are desired, the paper must be not unduly exposed during the other operations. Little experience, however, is required to make clear how much light the paper can stand without risk. The best plan is to fill the printing frame and do the developing as near the light as is convenient, interposing a sheet of cardboard or some other opaque screen in order to intercept its direct rays. No other precaution whatever is necessary.

Wellington S.C.P. can be printed by daylight, and provided the light is sufficiently subdued, can also be handled in daylight; but this latter is certainly not to be recommended, as there is great risk of light-fog resulting. The speed of printing is such that artificial light can be used very conveniently, and the light being quite uniform, there is little danger of making errors in exposure. Indeed, the latitude of exposure with Wellington S.C.P. is so great that, if artificial light is used for printing, there is no need for a single print to be spoilt.

If daylight is employed for printing, the room should have the window covered with yellow fabric (or "canary medium," as it is

called), one thickness being sufficient. There should be a small space in the window, closed by an opaque shutter, to be opened and shut quickly, as in the sketch below.



The shutter is closed while the packet of paper is opened and the printing frame filled. Then, after making sure that the packet has been wrapped up again, or slipped into a drawer or box, the printing frame is laid in front of the shutter in the window, which is opened for the few seconds required to make the exposure, and is then again closed.

The exposure to daylight is extremely short, usually not more than a second or two. This is another reason for preferring artificial light, as very short exposures are sometimes a little difficult to manage. Daylight moreover changes from hour to hour, sometimes from minute to minute, so that it is not easy to secure uniformity. With artificial light any number of exposures all exactly alike can be given without difficulty.

As will have been gathered from the preceding remarks, S.C.P. is a development paper, the effect of the light not being visible at

once. Many developers can be employed, but those which are given later have been carefully worked out to suit the paper, and experience has shown that they are the best. While very fine tones can be obtained with amidol, the metol-hydroquinone formula will be preferred by many, because the solution, if put up in well-stoppered bottles, will keep in good order for a long time.

The behaviour of S.C.P. in the developer is different in some respects from that of ordinary Bromide paper. With S.C.P. the image appears almost the moment the solution is poured on, development is complete in from 30 to 45 seconds, and the print, as soon as it is seen to be sufficiently vigorous, must be rinsed quickly and transferred to the hypo.

The " Vigorous " grades are intended for use with thin, flat, or foggy negatives, from which brilliant prints are thus obtained. For negatives of normal contrast, or for vigorous negatives, the " Normal " or " Soft " grades are recommended.

EXPOSING S.C.P.

Little need be said about this operation. The paper may be handled and the printing frame filled in diffused artificial light. There is no difficulty in recognizing the sensitive side. In glossy S.C.P. it is, of course, the shiny side ; in the matt varieties it is smoother and whiter than the plain paper at the back, and in all cases S.C.P. has a slight tendency to curl, always with the coated surface inwards. It is best always to expose at one distance from the light, as it is then possible to decide instantly upon the correct exposure by a mere glance at the negative. A very good plan to ensure the distance being the same is to fasten to one edge of the printing frame, by means of a screw, a piece of wood which will project straight out in front of the frame. This wood is cut to a suitable length, and then, whenever a print is being made, the frame is fixed so that the wood just touches some given part of the bracket or lamp. Six inches will be found a very convenient distance for quarter-plate or smaller negatives, but for larger sizes it is better

to use the frame farther off so as to secure even illumination The distance between the frame and the light should not be less than the diagonal of the negative. With a normal negative and a 32-c.p. electric light, at a distance of 12 inches, the exposure will be approximately 15 seconds. With incandescent gas the time will be rather longer, and with a paraffin lamp two minutes may be necessary.

If the presence of a little magnesium smoke in the room does not matter, a piece of magnesium ribbon burnt at a distance of 12 inches from the printing frame is an excellent method of printing. The frame may be stood up at one end of a piece of wood 12 inches long, and at the other may be put a spirit lamp at which to light the magnesium. At this distance a piece of magnesium ribbon half an inch long will be found about right for an average negative. A pair of pliers, or two coins, make a convenient holder for the ribbon, and a piece of card or blue glass should be held before the eyes while the ribbon is burning, or it will not be easy to see to develop immediately afterwards.

If printing is to be done by daylight, then, in a moderate light, from one to three seconds will probably be found correct.

S.C.P. can also be used for enlarging, both by daylight and by artificial light. Full instructions for this work will be found in the chapter on enlarging on pages 93 to 104.

DEVELOPING S.C.P.

The following are the formulæ which will be found most suitable for developing S.C.P. :—

METOL-HYDROQUINONE DEVELOPER.*

(Wellington Universal formula suitable for all Wellington Plates, Papers and Films.)

Metol	20 grains.	1 gramme.
Hydroquinone	60 „	3 grammes.
Sodium Sulphite (cryst.) ...	700 „	35 „
Sodium Carbonate (cryst.) ...	700 „	35 „
Potassium Bromide	6 „	0·3 gramme.
Water to	20 ounces.	500 c.c.

* *This developer is obtainable in packet form.*

The ingredients should be mixed in the order named, each one being completely dissolved before adding the next.

This developer keeps almost indefinitely in well-stoppered bottles.

For slightly softer results this developer may be diluted with an equal quantity of water.

N.B.—All metol-hydroquinone developers should be used at a temperature of from 60° to 65° Fahr. Below 60° Fahr. hydroquinone rapidly loses its developing power, and at very low temperatures becomes practically inert.

AMIDOL (DIAMIDOPHENOL) DEVELOPER.

Sodium Sulphite (cryst.) ...	1000 grains.	50 grammes.
Amidol (Diamidophenol) ...	100 „	5 „
Potassium Bromide	4 „	0·2 gramme.
Water to	20 ounces.	500 c.c.

The ingredients should be mixed in the order named, the sulphite being dissolved before the amidol is added. The solution will keep good for about three days only.

For slightly softer results this developer may be diluted with an equal quantity of water.

Whichever developer is selected, the print, supposing it to be not larger than half-plate, should be laid, face upwards, in a clean dish, and the developer poured quickly and evenly over its surface. The image will appear almost instantly, and should be watched until it is seen to be about the right depth, when the print is taken out, rinsed for one or two seconds only, and placed in the hypo solution. Prolonged washing between developing and fixing brings about discoloration. If the prints obtained are brighter than is desired, it will be found possible to increase the exposure slightly, and to use the developer diluted with its own bulk of water. Either developer may be used over and over again, but as soon as it is seen that the colour of the prints is not what it should be, the developer should be discarded and fresh employed.

Prints larger than half-plate are not easily covered with the developer in one quick sweep, and it will probably be found more convenient to allow them to soak in clean cold water for a few seconds, pouring off and draining away as soon as the print is limp, and then developing.

WELLINGTON BORAX-M.Q. DEVELOPER.

The following Borax-M.Q. developer (also referred to on page 26) can be used with success for the development of S.C.P. :—

Metol	20 grains.	1 gramme.
Hydroquinone	20 „	1 „
Sodium Sulphite (cryst.) ...	200 „	10 grammes.
Borax (powdered)	200 „	10 „
Water (hot)	20 ounces.	500 c.c.

Dissolve in the order given, allowing each chemical to be in complete solution before adding the next. This developer keeps almost indefinitely in well-stoppered bottles.

N.B.—All metol-hydroquinone developers should be used at a temperature between 60° and 65° Fahr. Below 60° Fahr. hydroquinone rapidly loses its developing power, and at very low temperatures becomes practically inert.

To prevent fog it is necessary to add one drop of a 10 per cent. solution of potassium bromide to each ounce of developer. The image will be of a black tone with a slight tendency to warmth, and softer in gradation than that given by the amidol and metol-hydroquinone formulæ previously mentioned.

By increasing the potassium bromide to 10 drops of a 10 per cent. solution per ounce, decidedly warm tones can be obtained. Development will take from three to four minutes.

FIXING AND WASHING S.C.P. PRINTS.

S.C.P. prints are fixed and washed exactly as described on pages 65 and 69 under the heading of Bromide paper.

They may be toned in the same way as Bromide prints, and the same method of finishing and mounting should be employed.

Wellington

B.B. Paper.

WELLINGTON B.B.—the initials mean Brown-Black—is a development paper, intermediate in speed between Bromide and S.C.P. In many important respects it differs from any of the papers previously described.

Bromide and S.C.P. with normal treatment give cool black tones. Subsequent toning allows of sepias and even reds being produced, but no really satisfactory method has been found whereby Bromide paper can be made to yield warm black tones.

It is only necessary to examine a collection of good mezzotints to be convinced of the beauty and suitability of warm black for pictures in monochrome, and it is hardly surprising that photographers should again and again, but hitherto without success, have sought for some simple means of imparting this colour to their prints and enlargements.

Wellington B.B. gives a warm black tone by simple development, just as readily and just as unfailingly as Wellington Bromide and S.C.P. give a cool black. A B.B. print, moreover, possesses a certain indefinable " quality " which distinguishes it from a print in any other process.

It would be futile to attempt to describe just what a good B.B. print is like. Only a trial of the paper, or an examination of some prints, can give any clear idea of this, but the following notes will be helpful to the reader in making a selection of the most suitable grade for his work.

Wellington B.B. paper is manufactured in the following grades :—

SEMI-MATT	...	Single and Double Weight.
TONED MATT	...	Single and Double Weight.
WHITE MATT	...	Single and Double Weight.
BUFF ...	...	Double Weight only.

B.B. SEMI-MATT possesses a particularly delicate surface, which is best described as being semi-matt without being semi-glossy. This grade retains when dry all the richness of the wet print, and is of special value for small work and for the rendering of fine detail.

B.B. TONED MATT might almost as appropriately be termed B.B. Cream Matt, but the cream tint is so delicate as to be usually imperceptible except by reason of its general effect on the image.

There is no doubt that the cream-toned base used for this paper greatly enhances its artistic value, and with a suitable subject the effect of the warm black image on the cream ground is strongly suggestive of a fine engraving. The " Thick " grade is well adapted to the making of prints and enlargements with wide margins.

B.B. WHITE MATT differs from the Toned Matt grade in that the paper has a pure white base. The term " white " as applied to paper being capable of rather wide application, it is as well to explain here that the base of the B.B. White Matt is free from any suggestion either of blue or cream, and in texture is similar to fine, smooth drawing paper.

B.B. White Matt is a paper which can hardly fail to appeal to the professional photographer who requires a white paper for " sketch " portraits and vignettes. With the Thick grade mounting may be dispensed with, the prints being enclosed in a folder and plate-marked or not as fancy may dictate.

B.B. BUFF is made with a base considerably deeper in tone than that of the Toned Matt grade. On this grade landscapes and

portraits against dark backgrounds yield rich mellow results which would be difficult to obtain in any other way.

Those who admire the effect of Collodio-Chloride paper toned in gold and platinum will find in Wellington B.B. an admirable substitute, giving results similar in colour and general effect, and rendering toning wholly unnecessary.

EXPOSURE.

The advice previously given in regard to exposing Bromide paper applies with equal force to B.B. With an average negative an exposure of from three to five seconds will be found approximately correct at 12 inches from a 32-c.p. lamp. It should be remembered that B.B. paper possesses quite exceptional latitude; and while this is a valuable property as a means of preventing waste, the photographer should not allow it to entice him into slipshod methods of working. As with any other paper, the best results will be secured by correct exposure and normal development.

DEVELOPMENT.

B.B. paper being slower than Bromide, a stronger light is permissible in the dark-room during development. The reader is recommended to take full advantage of this, as it will render his work more pleasant and his results more certain. One thickness of yellow glass or fabric will be found sufficient to make any ordinary light perfectly safe.

Various developers may be used for the development of B.B. paper, but the following are recommended :—

METOL-HYDROQUINONE DEVELOPER.*

Metol	20 grains.	1·2 grammes.
Hydroquinone	90 „	6 „
Sodium Sulphite (cryst.) ...	700 „	45 „
Sodium Carbonate (cryst.) ...	1000 „	65 „
Potassium Bromide	20 „	1·2 „
Water to	80 ounces.	2 litres.

The above ingredients should be dissolved in the order given and kept in bottles filled to the stopper.

* *This developer is obtainable in packet form.*

For warmer brown-black tones the potassium bromide may be increased to 40 grains.

If it is desired to use anhydrous instead of crystalline sodium sulphite and sodium carbonate, the following proportions will be found correct :—Sodium sulphite 350 grains (22 grammes), Sodium carbonate 350 grains (22 grammes).

The Amidol developer given below yields tones rather colder than those produced by the formula above mentioned.

AMIDOL (DIAMIDOPHENOL) DEVELOPER.

Sodium Sulphite (cryst.) ...	480 grains.	30 grammes.
Amidol (Diamidophenol) ...	35 „	2·2 „
Potassium Bromide	20 „	1·2 „
Water to	20 ounces.	500 c.c.

This developer will keep in good condition for three days only.

The Borax-M.Q. formula given on page 26 is also very suitable for the development of B.B. paper. The image is somewhat warmer in tone than that obtainable with the developers mentioned above and slightly softer in gradation.

As previously mentioned, B.B. paper possesses remarkable latitude, and a print over-exposed within reasonable limits may be saved by shortening the period of development. The aim of the worker, however, should be to produce, by correct exposure and normal development, prints not only good in quality, but of perfect uniformity. He should, therefore, endeavour to use his developer always at a standard temperature (from 60° to 65° Fahr. is the most suitable) and develop for a standard time. Unless intended for Sulphide toning, there is no need to develop a B.B. print to finality, as is recommended in the case of Bromide papers. The print will be all the better, so to speak, for having, when development is complete, a little exposure in reserve. At 65° Fahr. development will be finished in from one and a half to two minutes. The worker should remember that the warm black tone obtainable on B.B. paper is produced with unfailing regularity, provided the developer is used for a standard period at a uniform temperature.

A B.B. print as it lies in the developer always appears a shade or two darker than it does after fixing. This should be allowed for in developing.

B.B. paper is fixed and washed exactly in the same way as Bromide paper (see pages 65 to 69). B.B. prints, however, fix rather more quickly than Bromide prints, five minutes being sufficient provided they are kept separate or maintained in motion during the whole period of fixation.

TONING.

B.B. paper may be toned in any of the baths given on pages 72 to 76. The Hot Hypo and Alum process will be found the most suitable, but the Sulphide process can also be used with success. If this latter method is employed the prints should be developed to finality, as is recommended in the case of Bromide paper. B.B. paper tones to a distinctly warmer shade than Bromide.

FINAL NOTES.

B.B. paper, although slower than Bromide, is quite suitable for enlarging.

Very soft or very hard negatives are not the best for B.B. paper. A good Bromide or P.O.P. negative will be found the most suitable.

Do not under-expose.

Develop for a standard time, at a standard temperature, and the colour of your print will look after itself.

Remember that great over-exposure, coupled with brief development, will yield flat, muddy prints.

Wellington

Mezzotint Paper.

WELLINGTON Mezzotint is equally suitable for high-class portrait photography and landscape work. It is made in three grades, all double weight, viz. :—

Portrait—a perfectly smooth, cream tinted paper with very faint sheen. This grade is especially suitable for portraits and for other purposes where rich prints showing full detail are needed.

Smooth—similar to the above but with a pure matt surface showing faint natural grain.

Rough—a medium rough surface, slightly deeper in tint than the foregoing.

The paper yields prints resembling mezzotints both in quality and colour. The manipulation of the paper is remarkably straightforward. The latitude is exceptionally great and the warm tone is obtained with certainty. A negative of the ordinary studio type is the most suitable.

EXPOSURE.

Exposed to a 50-c.p. lamp at a distance of 18 inches a negative of average density and colour would require an exposure of from six to eight seconds.

The exposure should be timed to allow development to be complete in three minutes. The paper is quite fast enough for enlarging provided an illuminant of reasonable power is used.

DEVELOPMENT.

A carton of the special Mezzotint developer should be dissolved in 80 ounces of water to form a stock solution. If the small packets are used the solution should be made up to 10 ounces. For use this solution should be diluted with twice its own volume of water. With thin negatives the stock solution may be used at full strength in order to secure the maximum degree of brilliance, and for use with hard negatives it may be diluted with three parts of water.

Using a developer diluted with two parts of water the image will appear in one minute, and development will be complete in from about three to three and a half minutes. Unduly short develoment should be avoided.

The developer should be used at a temperature of 60° to 62° Fahr. There is no need to warm solutions above this temperature.

After development the prints should be rinsed and fixed in either of the acid or the acid-hardening baths given on pages 65 and 67.

The instructions given under the heading of Bromide paper on pages 67 to 71 apply equally to Mezzotint paper.

For those who prefer to make up their own solutions the following formula is recommended :—

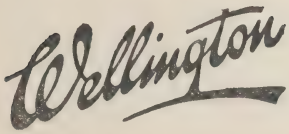
Metol	10 grains.	0·7 grammes.
Hydroquinone	120 „	8·5 grammes.
Adurol or Glycin	120 „	8·5 „
Sodium Sulphite (cryst.) ...	5 ounces.	150 „
Sodium Carbonate (cryst.) ...	5 „	150 „
Potassium Bromide	15 grains.	1 gramme.
Water to	80 ounces.	2,500 c.c.

This stock solution should be diluted with twice its own volume of water when used with normal negatives, with three times its own volume when used with hard negatives, and should be used full strength for soft negatives.

PORTRAIT STUDY

Photograph by E. O. Hoppé on a Wellington Anti-Screen Plate.
Reproduced from a print on Wellington Press Enammo.

Enlarging on



Bromide B.B. and S.C.P.

FOR many years there has been a tendency on the part of both amateurs and professionals, to abandon the large camera, and to rely on enlargements from quite small negatives when big pictures are required.

This course has much to recommend it. Fast plates are now so perfect that one of the greatest drawbacks to hand-camera work has been removed, and on such papers as the Wellington Bromide, S.C.P., Mezzotint or B.B., enlargements leave nothing to be desired on the score of quality.

In selecting suitable negatives for enlargement—or in making negatives from which enlargements are likely to be required—the reader should bear in mind that softness is to be preferred to brilliancy. A negative capable of making a good print with a reasonably short exposure on Wellington Bromide or B.B. will probably yield an equally good enlargement, although many negatives are capable of giving better enlargements than contact prints, and it often happens that enlargement is the means of revealing unexpected charm in what seemed originally an unpromising subject.

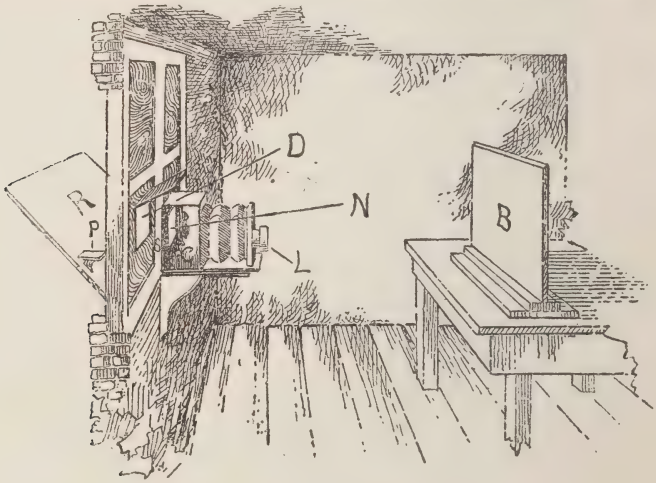
Enlarging is simply re-photographing, only for convenience certain alterations are made in the disposition of the apparatus. The photographer knows that as he gets nearer to his subject the image gets larger on his focussing screen, and the camera has to be extended more and more in order to secure definition. If a small negative is fixed so that it is evenly illuminated from behind,

and we have a camera sufficiently large and capable of extending far enough, it will be possible to set such a camera in front of the negative, focus to the required size, and then, using a piece of Bromide paper instead of a plate, make a photograph of the negative. On development this will be found to be a positive print, just like a contact print of the same negative, only of a larger size. This is enlarging in its simplest form. But as, in order to get an enlarged picture, the lens of the camera must be nearer to the object—*i.e.*, the original negative—than the Bromide paper is to the lens, and as the latter distance may have to be several times the focus of the lens, the extension required is so great that it is not usually convenient to employ a camera of the ordinary type, and therefore some form of special apparatus is used.

ENLARGING BY DAYLIGHT.

The method which requires the least quantity of special aparatus is one in which the work-room itself becomes the camera, as shown in the sketch below.

The window of the work-room has been blocked up with an opaque shutter, so that no light can enter except through the



negative, shown at N. A reflector outside, R, is covered with white paper and so illuminates the negative evenly. On a support inside the room is placed the ordinary camera, with its lens pointing into the room, while at some little distance beyond is fastened a drawing board, B, on which the paper is fixed.

This, it will be seen, is re-photographing, with the whole of the darkened work-room as the camera.

The bellows of the camera C only serve to block out strong light from the room, and a focussing cloth or some similar object must be put at S to make a light-tight joint between the back of the camera and the board carrying the negative. The focussing screen of the camera is, of course, removed, focussing being effected on a piece of white paper fastened to the easel B.

When such an arrangement is possible it forms a very cheap and convenient way of making enlargements, and the results will be found equal to those obtained with the most expensive outfit. The only drawbacks are that it involves the darkening of a room and that work can only be done in the daytime.

The lens L may be provided with an orange-glass, which is put on after focussing. This allows the image on the easel B to be seen clearly enough for the sensitive paper to be adjusted in the correct position, exposure being made by taking off the cap.

EXPOSURES IN DAYLIGHT ENLARGING.

As daylight is very variable, it will be found a good plan always to measure with an exposure meter the light falling on the reflector R, as nearly as possible at the moment of making the exposure itself. If this is done, and a note is kept of the stop used and of the negative, it is simple enough to ascertain approximately what exposure will be needed for any other negative. In enlarging, as in contact printing, different negatives require different exposures according to their density and colour.

The stop value in enlarging differs completely from that engraved on the lens, and must be measured for the particular exposure in hand.

If the lens is fitted with an iris diaphragm, we may measure once for all the diameter of the opening for the different stop numbers, by unscrewing the lenses and pushing into the iris, as far as it will go, a piece of card cut into a V shape. We can then make a list like the following :—

F/8 —$\frac{1}{2}$ inch diameter.
F/11—$\frac{4}{11}$ inch diameter.
F/16—$\frac{1}{4}$ inch diameter.
F/22—$\frac{2}{11}$ inch diameter.
F/32—$\frac{1}{8}$ inch diameter.

The measurements will, of course, vary according to the focal length of the lens employed. The above figures would be correct for a lens of a focal length of 4 inches.

This list is kept at hand when enlarging. When all is ready for exposure, the distance from the iris of the lens L to the easel B is measured with a tape measure, and this distance divided by the diameter of the stop. The answer is the real value of the stop that is being used.

An example will make this clearer. Let us suppose that the stop in use is that marked F/22 in the list above, and that the distance from the iris to the easel is found on measurement to be 35 inches. As F/22 has a diameter of $\frac{2}{11}$-inch, we divide 35 by $\frac{2}{11}$. That is to say, we multiply 35 by 11, which gives us 385, and divide this by 2, getting 192. So that under those circumstances we are using F/192 actually, although the stop is marked F/22.

Using the same stop, and the same negative, the exposure will always be strictly proportional to the time taken for the meter paper to darken.

Suppose, therefore, that one day using Wellington Bromide paper and F/192 we find that the exposure meter placed on P takes 28 seconds to darken to the standard tint, and that with a certain negative an exposure of six minutes proved to be correct. A week later, we want to make another enlargement of the same size from the same negative (or from one identical in density and colour) and we test the light again and find that the meter now

darkens in 16 seconds. A simple proportion sum gives us the exposure.

Six minutes are 360 seconds. We multiply the former exposure by the latter exposure-meter-time, and divide by the former exposure-meter-time. That is to say, we multiply $360 \times 16 = 5760$ and divide this by $28 = 206$ nearly. The correct exposure under the altered conditions is therefore 206 seconds, or, say, three and a half minutes.

Should the degree of enlargement be altered, or the size of the stop, or both, it is easy to calculate the corresponding change in exposure. We must first find out, as described above, the new value of the stop. Then the exposure varies as the square of the " F " value of the stop.

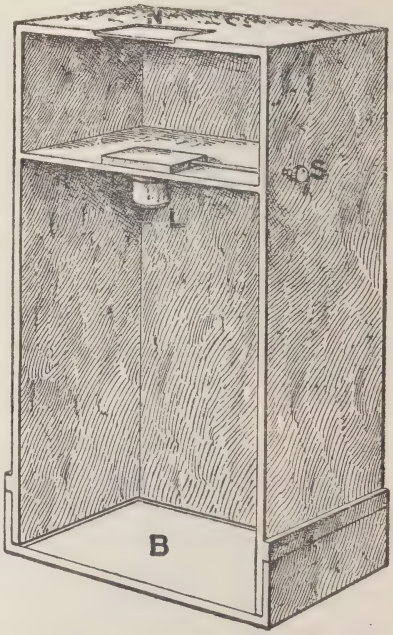
Let us continue the example. We have just seen that under certain conditions we found that with stop F/192 the exposure was three and a half minutes. But we will suppose that we have altered the scale of our enlargement, so that, on working it out, we find we are no longer using F/192, but F/150, and we want to know the corresponding exposure.

We multiply 192 by 192, getting 36,864, and 150 by 150, getting 22,500. Then we know that the exposure under the new conditions bears the same relationship to the exposure under the old conditions as 22,500 does to 36,864. We can ignore all the hundreds and deal with the thousands only. So the relative exposures are 22,000 and 36,000, or 22 and 36, or 11 and 18. Multiplying the three and a half minutes by 11 and dividing by 18, we get two minutes eight seconds, which would be the exposure under the new conditions.

It is well to have a little projection P on the reflector, where it will not interfere with the even lighting of the negative, and always to put the exposure meter on that projection when measuring the light. If the reflector cannot be got at from the outside, which will be the case if the work is being done in an upstairs room, the window may be opened at the bottom and a door provided in the blocking-out board at D, so that the meter can be passed in and out.

Before leaving this part of the subject, it should be pointed out that it is most important to ensure the easel being square with the negative, as otherwise the picture will be distorted.

If the lens used is that with which the original negative was taken, it will give a satisfactory enlargement to any size that may be required; if not, the lens must be one that is at least capable, in the ordinary way, of covering a plate the size of the original negative right up to the corners.



FIXED-FOCUS DAYLIGHT ENLARGERS.

There is another method of daylight enlarging, in which a special enlarging apparatus is employed. This may be adjustable to take negatives of various sizes, and to make enlargements of different sizes. The form usually met with is not adjustable, but is a fixed-focus arrangement, in section similar to the sketch shown on this page.

As before, N. represents the negative, L the lens, and B the Bromide paper, S being a shutter actuated by a knob outside the apparatus, by which the exposure is effected. In its simplest form there is a lid at B, and the whole apparatus is taken into the dark room, a piece of sensitive paper is put inside it at B, by means of the lid, which is then fastened, and the apparatus is carried out into the open air, so that there is an unobscured view of the sky above the negative N. The exposure is then made by means of the shutter S. Direct sunlight must, of course, be avoided.

In a fixed-focus enlarger of this sort, there is no need to trouble about stop values, as the apparatus always works at the same stop.

Using the same brand of paper, and the same (or a similar) negative, the exposure will always be in proportion to the strength of the light as measured by a meter which can be placed on the top of the apparatus just before exposing. Once the correct exposure with a given negative is known and the time taken by the meter slip to darken has been recorded, all future exposures for the same or a similar negative can be worked out in the following manner :—

Multiply the number of seconds of the known (*i.e.*, first) exposure by the number of seconds taken by the meter slip to darken under the new conditions, and divide by the number of seconds it took to darken when the known (*i.e.*, first) exposure was made. The answer will be the exposure required in seconds.

EXAMPLE.—It is known that on a certain occasion when the meter slip took 15 *seconds to darken, a negative required* 40 *seconds exposure. It is desired to make another enlargement from the same negative and it is now found that the meter slip takes* 12 *seconds to darken. To find the exposure required multiply* 40 *by* 12 *and divide by* 15. *The answer is* 32, *i.e., the number of seconds exposure necessary.*

The fixed-focus enlarger is a very simple form of apparatus, but much good work can be done with it. Its disadvantages are that the worker is limited to a particular size of enlargement, and that he has but few facilities for controlling his results by shading portions of the picture during printing.

ENLARGING WITH A LANTERN.

An enlarging lantern is simply a projection lantern, in which special care has been taken to prevent light leaking out into the room in which it is being used. The negative is put into the position occupied by the slide, and sharply focussed on the easel. The lens is then capped with the orange-glass cap, and a piece of Wellington Bromide, B.B., Mezzotint, or S.C.P. is pinned on the board and the exposure made.

Most enlarging lanterns are fitted with a condenser, the function of which is to bend aside the rays of light so that they pass through the negative and also through the lens.

A form of enlarger is also made in which, instead of a consenser behind the negative, there is a reflector illuminated by one or two lamps so fixed that no light from them strikes directly on the negative. This apparatus works very well, but exposures are much longer than when a condenser is used.

In a third form of enlarger the lens points downwards towards a table on which the Bromide paper is placed, the focussing being effected automatically by a mechanical arrangement. This is a very convenient type.

The action of the condenser is to bend aside the rays of light, so that after passing through the negative they all pass through the lens, generally more or less through the middle. Consequently, it may happen that the lens can be stopped down without cutting off any of the light passing through it. The operator should, therefore, remember that when a condenser is used the effect of stopping down no longer follows the rules that apply when using the camera in the ordinary way. If the stop is altered, there is only one satisfactory way of ascertaining its effect upon exposure, and that is by a trial exposure.

In setting up an enlarging lantern for work the first thing to be done after lighting up is to put the negative in position and settle the size of the picture on the easel. When the negative has been focussed on the easel it is taken out again and the position of the light altered until the screen shows a perfectly even illumination. Some forms of enlarging lantern have the position of the light fixed once for all, but in most there is scope for a little adjustment to get the best result. The negative is then replaced and focussed as sharply as possible, the orange cap is put on the lens, the Bromide paper pinned up and the exposure made.

Focussing should be done on a sheet of white paper the same size as that which is to be exposed. This makes it easy to select

with certainty the exact part of the original negative which is to appear in the enlargement.

It will be found that little pinholes or specks in the negative are the best guides to the sharpness or otherwise of the focussing, because the details of the original may not be quite sharp, but the edges of a pinhole are sure to be.

It is a mistake to use a smaller stop than is necessary to get the required definition. It not only prolongs exposure, but with some forms of illumination it makes the lighting uneven.

In enlarging either with the camera by the method first described or with an enlarging lantern, the photographer can stand beside the sheet of paper on the easel and by means of cardboard can shade parts of the picture so as to let the rest have longer exposure and thus print darker. This is a very valuable power, and a great deal can be done to improve the result, with comparatively little skill. The card must be held well away from the face of the paper on the easel, or must be kept moving, to prevent its edge from showing as a hard line. If all but a small piece of the picture is to be darkened in this way, a ball of cotton-wool may be fastened to the end of a wire, and used to shade the one part that is not to be darkened; while if only one small portion is to be darkened, a card with a hole cut in it may be so held that the light passes through the hole, while the card screens the other part of the image.

It is a comparatively easy matter to print clouds into enlargements. The landscape is first sharply focussed on to a large piece of paper on the easel. This must be larger than the Bromide paper, as it must project on either side of the Bromide paper when this is pinned on. On this is placed a piece of card, also a little larger than the Bromide paper, and on this the skyline of the landscape is carefully drawn with a sharp pencil. The card is then cut into two pieces along this line with a sharp knife. This gives two masks which may be used to shade the landscape while the sky is being exposed, and the sky while the landscape exposure is being given. As there is no visible image on the Bromide paper, it is not possible, without some guide, to know where the skyline of the

landscape comes, so that one of the masks is put back on the easel in its original position and its outline traced in pencil on the white paper. That part of the outline which will be covered up by the Bromide paper need not be marked, but the two extremities which will be seen when the Bromide paper is pinned up should be clearly shown. If the whole of the negative is to be got on the Bromide paper, there will, of course, be no skyline beyond its edges, in which case the outline on the card may run off in a straight line where it is marked on the paper on the easel. The idea is, of course, to provide some guide, so that after the landscape negative has been put in the enlarger and the exposure made, one may know, when the cloud negative has been substituted, where to hold the card mask so that it protects the invisible landscape image on the paper, while the cloud exposure is being given. The masks must be kept moving as before, and it will be found advisable to use the sky mask when exposing for the landscape, even if this has a fairly dense sky.

There is another method of putting in clouds, with which some workers are very successful. The landscape portion is first exposed, shading the sky as much as possible, and is then developed. If the exposure is correct, a little longer in the developer does no harm, so that after the paper is developed it can be washed for a minute or two, drained, pinned up again on the easel while still wet, and exposed for the clouds, shading the landscape with a card. This is easily done, as the picture is, of course, quite visible. The enlargement is then put back into the developer until the clouds have developed, and is then fixed in the ordinary way.

This method should not be used if sulphide toning is contemplated, as there will always be a risk of the landscape, by reason of the long development it has undergone, toning to a colder colour than the sky.

DIFFUSION IN ENLARGING.

Some very effective enlargements may be made by the help of a material known as "bolting silk" or "bolting cloth," and sold under that name by most of the large photographic dealers.

It is a fine, even-textured fabric, made primarily for sifting or bolting flour. A piece a little bigger than the largest enlargement that is to be made should be obtained and stretched on a frame, or else mounted by its edges to a clean piece of glass, for protection. It is used by being placed just in front of the Bromide paper, on the easel. If it is placed with the bolting silk in contact with the Bromide paper it breaks up the image into a series of little dots something like a very fine half-tone picture in a magazine. This is useful if the original negative is too harsh in its contrasts, as the deepest shadows do not then come so black and the result is more harmonious.

If it is separated from the Bromide paper by about the thickness of an ordinary sheet of glass, this texture can no longer be seen, but the effect is to soften the lines of the picture. The further it is from the paper the greater will be the diffusion, and in this way any degree of softness that may seem necessary can be secured at will.

It is quite a different softness from that got by leaving the picture out of focus, and is often "the making" of an enlargement which, without some such device, would be cuttingly sharp. It also hides pinholes and other slight blemishes on the negative. A magnificent effect can be secured from a suitable negative by enlarging very considerably on Wellington Cream Crayon Bromide, using bolting silk to soften the definition, and then sepia toning the result. A quarter-plate or smaller negative can in this way provide a striking picture 24×18, or even larger.

It is important, when using bolting silk, to have the separation between the Bromide paper and the silk uniform over the whole enlargement. If it is not, the character of the definition will alter unpleasantly in different parts. For this reason it is best to stretch silk on a sheet of glass. If no separation is required, it is then pressed down on the Bromide paper and secured with dark-room pins. If a slight separation is required, it is turned so that the glass side is in contact with the Bromide paper and fastened as before.

Chiffon can also be employed for creating diffusion in enlargements. All that is necessary is to place one, two, or three thicknesses of the material, according to the degree of diffusion required, over the enlarging lens. There is a distinct advantage in using chiffon in preference to bolting silk, as all that is required is a small piece sufficient to cover the lens and allow all round an inch or two margin which is placed over the lens mount and held in position by an elastic band. Fixed in this way, the same piece of chiffon can be used for all sizes of enlargement.

The enlarged image should be focussed sharply on the enlarging easel and the chiffon then placed in position as described above. It will be found that the use of diffusing material necessitates an increase in the exposure, but not sufficient to cause any inconvenience in working.

Another plan is to cut a circle from a lens cap, stretch a piece of black chiffon over the aperture thus made and fasten it with seccotine. The method of using this device is to give the first half of the exposure with the bare lens and the second half with the chiffon cap over the lens.

The subsequent operations in enlarging are the same as for contact prints.

ENLARGING ON S.C.P.

Although the exposure is many times longer than that required for Bromide paper, Wellington S.C.P. can be used quite successfully for enlarging. Care must be taken not to use too strong a light in the room in which the work is done ; indeed, if the paper has to be exposed on the easel for, say, half-an-hour, it is better to extinguish the light altogether or to use a yellow or red light as for Bromide paper. S.C.P. is an admirable paper for use in daylight enlargers.

STILL LIFE STUDY

Photograph on a Wellington Anti-Screen Plate.
Reproduced from a print on Wellington Press Enammo.

Seltona

Collodion Self-toning Paper.

SELTONA is a daylight printing Collodion Self-toning Paper requiring no toning, fixing in hypo, followed by the usual washing, being all that is necessary. It is made in the following grades :—

MATT, CREAM, ANTIQUE WHITE, ANTIQUE CREAM and GLOSSY, all grades being supplied in Single Weight and Double Weight (Boardoids), and in post-cards.

TINTONA is Seltona emulsion on a Double Weight tinted base. Its manipulation is identical with that of Seltona. Very striking and pleasing effects may be secured on Tintona if the tint of the paper and the colour of the image are selected to suit the subject.

Tintona is made in four tints :—CREAM, BLUE, GREEN and GREY, and is also supplied in the form of post-cards.

In point of artistic merit, a print on Seltona is equal to the best results obtainable in any photographic process. At the same time, the necessary operations are so simple that, given reasonable care, the work of the beginner should be indistinguishable from that of an experienced printer. Such a paper obviously offers great attractions to photographers of every class. For the beginner it is certainly the easiest of all photographic processes, and, as the results possess all reasonable permanence, it is worthy of a place in any professional studio.

PRINTING.

The negative is placed in a printing frame, a sheet of Seltona inserted, the frame closed and then placed on a window sill or anywhere in the open so that the light may act on the paper through the negative.

The paper should not be exposed to an unduly bright light while being placed in the frame. The operation is best carried out in a room a few feet away from the window. Printing should be done in the shade rather than in bright sunlight.

From time to time the paper should be examined to see how printing is progressing. At first only a faint image will be seen. Then this will become darker until a stage will be reached when the print will look just a little too dark and heavy. This is the moment to stop printing. Take the frame indoors, remove the paper and place it in an empty box of some kind to protect it from further light action.

If there are other prints to be made they should be proceeded with in the same way and the results placed together in the box.

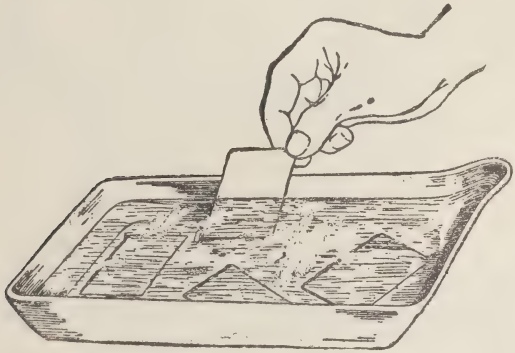
In their present state the prints would quickly go black if exposed to daylight. Therefore they must be fixed.

FIXING.

Two perfectly clean dishes are required, the larger within reason the better. Fill the first with water to a depth of about half an inch. In the second pour a quantity of hypo solution to a depth sufficient to ensure the prints being kept well covered. For a small number of prints half an inch of solution will suffice ; for a larger number a depth of an inch or more will be needed.

The hypo solution is made by dissolving two ounces of hypo in one pint (20 ounces) of water. If no scales are available a level tablespoonful of hypo crystals may be taken as an ounce, and a domestic tumbler will provide a sufficiently accurate half-pint (10 ounce) measure.

In cold weather it is better to use warm water when mixing the hypo, as the dissolving of the crystals reduces the temperature of the solution and very cold hypo acts slowly and does not give a good colour.



Now take the prints in dry clean fingers and slip them one at a time face downwards in the first dish. Turn them over and over, by taking the bottom print and placing it on top, and at the end of about one minute pour off the water and replace with fresh. Continue turning over the prints, and at the end of another minute change the water again. Keep the prints moving for yet another minute and then place them quickly, one at a time, in the hypo solution in the second dish.

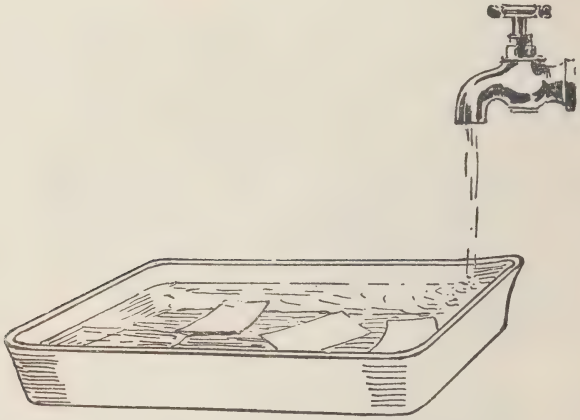
In this dish, as in the first, the prints must be kept moving by turning them over and over, always taking the bottom print and placing it on top. It is essential, of course, that the prints be kept well covered with the hypo solution.

Soon the prints will assume a beautiful sepia tone, and if the negatives have been even reasonably good the user will be charmed with the exquisite quality of his results.

At the end of ten minutes the prints should be removed to a bowl or dish of clean water, turned over for a minute or two, and then allowed to wash for at least one hour.

WASHING.

Washing as applied to a photographic print is, of course, very different from washing as generally understood.

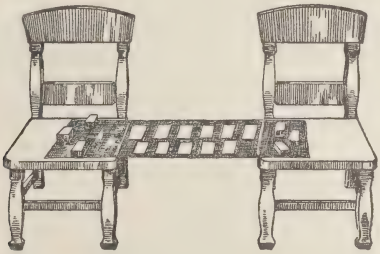


Soaking would be a more appropriate word, but soaking alone is not sufficient. The prints must be kept separated from each other and the water changed frequently. If the bowl or dish used for washing is placed under a tap a stream of water can generally be arranged to fall on the edge of the dish to keep the prints gently moving and at the same time ensure a continual supply of fresh water. Care should be taken that the water does not fall strongly on the prints themselves, or they may be damaged. If running water be not available the water should be changed about a dozen times at regular intervals.

DRYING.

All these operations are extremely simple. After washing, as described above, the prints will be ready for drying, which may be accomplished by laying them face downwards on a clean piece of muslin stretched between two chairs or in some similar way.

If preferred, the prints may be hung up by means of pins or clips, or they may advantageously be dried before the fire. With Seltona there is no risk of the film melting.



Before drying prints, surface moisture should be removed by means of a clean sponge or cloth, or by blotting the prints with pure photographic blotting paper. Drying should be done quickly and, if possible, in a current of warm air. Prints must never be dried between blotters, and pools of water should not be allowed to remain on their surface.

HOW TO OBTAIN COLD TONES.

If the worker has carried out the preceding simple instructions he will have produced a set of excellent prints of a pleasing sepia tone.

Few users will desire any other colour, but those who prefer a colder tone may easily obtain it in the following manner :—

Instead of placing the prints in water for the first wash, place them in—

Common Salt	2 ounces.
Water to	20 ounces.

The salt should be common salt, and not a patent variety of table salt which sometimes contains substances other than sodium chloride.

In this solution the prints are kept moving for ten minutes exactly as described above. At the end of this period the salt solution is thrown away and replaced with clean water. The prints are turned over, the water changed once or twice, and the prints then transferred to the fixing bath and finished in the ordinary way. The resultant prints will be of a dark brown tone, tending to purple. The stronger the salt bath the colder will be the tone.

Prints intended for this treatment should be made rather darker than usual.

PLATINUM TONING FOR WARM BLACK TONES.

Prints of exceptional beauty can be made on Seltona by employing a platinum solution for toning. Printing must be carried very much further than usual—until the shadows are considerably over-done, and the high lights are degraded.

Place the prints face downwards in a dish of clean water, and give them three changes.

The toning bath is prepared as follows :—

STOCK SOLUTION.

Chloroplatinite of Potassium ...	15 grains.	1 gramme.
Citric Acid	1 ounce.	30 grammes.
Common Salt	½ „	15 „
Water to	10 ounces.	300 c.c.

For use take—

Stock Solution	1 part.
Water	10 parts.

Used solution may be kept and employed instead of water for diluting the stock solution.

This solution can be obtained ready for use under the name of Seltona Platinum Solution.

The prints are now slipped, one by one, into the platinum bath and kept constantly moving to secure even toning. The completion

of the process is not to be judged by the surface appearance, but by holding the prints up to the light and looking through them. Toning must be continued until the brown shadows are seen to have become cool in tone like the rest of the print. Care must be taken during toning not to expose the prints to strong light more than is absolutely necessary.

As each print is finished it is transferred to clean water, and then the whole batch is washed by means of three or four changes. Prints are then fixed and washed as for warm tones.

When using the platinum bath avoid fingering the surface of the prints, as this is liable to cause stains. It is an advantage to warm both the platinum solution and the first washing water. The results produced in this way are superior both in tone and quality to those produced with cold solutions.

FINAL NOTES.

Drying prints slowly in a damp room, or placing them under pressure before they are bone dry, may produce stains.

If prints are not fixed immediately after printing, keep them under slight pressure, *e.g.*, under an old negative glass in an ordinary plate box.

Do not finger the surface of the paper at any stage of the printing and toning operations. Handle the prints at the edges only.

Use dishes at least twice as large as the prints, and do not inconveniently crowd the dish. Friction of the prints against one another may injure their surface.

In cold weather make up baths with tepid water.

See that the dishes are perfectly clean; preferably reserve dishes specially for Seltona and use always the same dish for the hypo bath.

Use a fresh hypo bath for each batch of prints.

Do not glaze Collodion prints. Results are unsatisfactory. The natural gloss of Seltona is sufficient.

Never leave water on the face of a print.

Prints must be bone dry before mounting.

Mounted prints should never be stacked until bone dry.

When examining prints during printing always open the larger section of the back of the printing frame so that the paper may not be bent back sharply and thus cracked.

A Seltona print after drying changes to a slightly colder tone.

All self-toning papers are liable to become yellow if kept in stock for any considerable length of time. This yellowness disappears in the fixing bath and has no influence on the final result.

COLOURED PRINTS ON SELTONA.

It is not generally known that with Seltona it is possible to make prints which will have all the appearance of photographs in natural colours.

The process in its simplest form is extremely easy, but produces pleasing and, in some cases, most beautiful effects.

As already explained, Seltona yields warm or cold tones according to the method employed.

The following are the colours obtainable :—

Washing before fixing : Reddish-brown or sepia.
Fixing without previous washing : Nut brown.
Salting before fixing : Dark brown to purple.
Strong salt before fixing : Purple to blue.

To work the process in its simplest form, choose a negative containing, say, a full length or three-quarter length figure, and print a little darker than the print is desired to be when finished. The paper or card may be of any surface, though the glossy requires most care in toning.

For the first attempt, get an egg-cup full of salt and water as strong as possible, and with a paint brush cover all the picture except the face and hands or other exposed flesh with the solution, allowing the whole painted surface to change colour evenly. Then put the print in the hypo bath and fix and wash in the ordinary way.

The face and hands to which no salt water has been applied will appear flesh coloured by contrast, while the rest of the picture will be violet. Where the face, hands, arms, &c., are delicately shaded, the effect is wonderfully real, because the natural colour of the print with all the original shading is retained.

When treating a subject such, for example, as a landscape at sunset, one would paint the whole surface with strong salt water, omitting streaks and light clouds in the sky, and also any reflections in water, and any object upon which the red light of the setting sun would fall. The edges where the strong salt solution had been applied should be lightly touched with a brush dipped in weak salt solution, so that no hard lines may appear. The point in the sky where the sun had dropped, and points where the red light is most vivid, should be painted with plain water several times to give as bright a red as possible. Reflections on leaves of trees, water, window panes, &c., should be treated in the same way.

A more difficult subject would be a large bust. Here the artist should paint all but the exposed flesh with strong salt water, and treat the face, using a fine brush, with weak salt water, and plain water. The cheeks should be "stroked" with plain water to heighten the colour, and the eyes and parts immediately beneath the eyes should be delicately painted with weak salt water. The whole would require considerable care, but when properly done, an exquisitely tinted picture would be produced.

Wellington

P.O.P.

WELLINGTON P.O.P. is characterised by excellent keeping properties and by a remarkable freedom from "double tones." It is made in two grades: GLOSSY and MATT.

A special grade, called Tropical P.O.P., is manufactured for use in hot climates.

P.O.P. should be handled in exactly the same way as Seltona, and the method described on page 106 should be carefully followed.

Printing should be carried out in a bright light, but direct sunlight should be avoided.

If the negatives are very thin, a piece of green glass, or, if that is not available, green or white tissue paper, placed over the frame, will enable a more vigorous print to be obtained.

The depth to which printing should be carried is easily learnt. There is a certain amount of falling off in the processes of toning and fixing which must be allowed for, but this is not very great. The prints when taken from the frame must, therefore, look a little darker than it is desired that they shall be when finished.

If the paper or the negative is damp, or if either become damp during printing, the silver salts in the paper will affect the negative, giving rise to dark spots called silver stains. If these spots are not very intense they can sometimes be removed by placing the negative for an hour or two in the combined toning and fixing bath, to be described later on. The negative must then be thoroughly washed and dried.

Another method of removing silver stains is to rub the negative lightly with metal polish ("Globe," or one of the liquid polishes

is suitable), applying with a tuft of cotton-wool and polishing off with a clean piece. The surface of the negative will now look almost as shiny as glass, and the stains will have been greatly reduced in intensity. The negative is then placed in a clean fixing bath for an hour or so, when most of the stains will entirely disappear. Thorough washing is, of course, necessary to complete the operation.

When a fair number of prints are ready they can be toned. It should be remembered that to secure the best possible results prints should be finished the same day as printed. Moreover, prints are never so good if the printing itself is begun on one day and finished on the next.

TONING P.O.P.

Before toning the prints must be washed in several changes of water or, better still, in running water. This need not take more than a quarter of an hour, but it is important that it should be thorough. In this, as in other processes, it is not sufficient to leave a number of prints in water lying on the top of one another: they must be separated, and separately drained when transferring from one bath to another. After the washing the prints must be placed quickly, one at a time, in the following toning bath :—

SULPHOCYANIDE TONING BATH.

Ammonium Sulphocyanide ...	20 grains.	3 grammes.
Gold Chloride	2 „	30 c.c. (1% sol.).
Water to	16 ounces.	1 litre.

An excess of the sulphocyanide beyond the quantity given should be avoided, or pink high-lights and half-tones, and the defect known as double toning, *i.e.*, red shadows and bluish high-lights, may result. The sulphocyanide must be dissolved in the water first, and then the gold, previously dissolved in water, added. A deep red colour will be seen for a moment, and as soon as the solution

is free from this it is ready for use. Sixteen ounces (450 c.c.) are sufficient for 24 half-plate prints. (For instruction regarding the preparation of the gold chloride solution, see page 147.)

It is most important that the prints be kept moving while in this solution. They should be turned over and over, the bottom one being continually placed on top, so that each print receives attention in turn.

The progress of toning must be judged by transmitted light—that is to say, by the appearance of the prints when held up to the light and looked through. The exact depth to which they should be toned is to be recognised without difficulty when one or two have been made. It is essential, however, if the prints are to be of a uniform colour, that toning be always done in the same light—that is to say, if daylight is generally used, the worker will find himself all astray if he tries to tone his prints to a similar tone by lamplight.

It should be remembered when toning prints that they always dry a good deal colder in colour than they appear when wet. They should, therefore, be taken from the toning bath while still decidedly red if a warm tone is desired. If a colder shade is wanted, then toning must be stopped at the purple-red shade. Care should be taken not to over-tone, otherwise flat, colourless prints will result.

A quantity of solution sufficient for a given number of prints having been prepared, the whole of the prints to be toned should be placed in the bath as quickly as possible, taking care that each is placed well under the solution, kept moving, and that none of the prints are allowed to cling together. The batch having been toned, the solution should be discarded and fresh used for the next batch. If the proportion given above, *i.e.*, 16 ounces of solution for 24 half-plates, is observed there will be little waste of gold. Strengthening up an old bath for use on a second occasion will have the result of producing inferior prints without effecting any economy in chemicals. Rather less than the above quantity will be necessary for vignettes or for prints to be toned to a warm colour.

Too many prints should not be placed in the toning bath at a time, or they cannot be properly watched. As soon as it is judged that toning has been carried far enough, the print is removed and placed in clean water. In this it must be kept moving for the first minute or so and the water changed, or the toning action will continue and the print when finished will be of a colder tone than was intended.

THE FIXING BATH.

The prints are transferred one by one from the washing water to a solution of hypo. The strength recommended is—

Hypo	2 ounces.	50 grammes.
Water to	20 „	500 c.c.

This should be made some little time before use, as freshly dissolved hypo falls to a very low temperature and is consequently slow in action. The prints must remain in the solution for at least ten minutes, and must not be left in a solid mass, but should be kept moving separately all the time. More prints go wrong through imperfect fixing than through insufficient washing.

COMBINED TONING AND FIXING.

Many people like to use one solution for the two-fold purpose of toning and fixing. While the combined bath is not to be recommended, it will give very beautiful tones with a minimum of trouble.

When this method is to be used, the prints should first be immersed for ten minutes in a solution of half an ounce of sodium sulphite (15 grammes) in a pint (550 c.c.) of water. This preliminary treatment with sodium sulphite prevents after-yellowing of the prints by age. After thorough washing in many changes of water, they are toned and fixed in the following solution :—

COMBINED TONING AND FIXING BATH.

Hypo	8 ounces.	260 grammes.
Citric Acid	20 grains.	1·5 „
Alum	200 „	14 „
Lead Acetate	20 „	1·5 „
Hot Water to	30 ounces.	1000 c.c.

The hypo is first dissolved in the hot water, and then the other ingredients are added in the order named. The bath is allowed to stand until cold, and the clear liquid decanted or filtered off for use. Of this liquid six ounces (170 c.c.) are taken, and one grain (7 c.c of 1 per cent. solution) of gold chloride, dissolved in water, added. As in other cases, the prints are much colder in tone when dry. (See notes on p. 147 under Gold Chloride.)

WASHING, DRYING, MOUNTING, &c.

The prints now require washing. There is no need to repeat the instructions previously given, as in all these respects P.O.P. and Bromide paper require identical treatment. The reader should therefore turn to pages 68 to 72 and follow the directions there given.

Prints on Wellington P.O.P. may be glazed exactly as described on page 72.

SOUTH AISLE, DURHAM CATHEDRAL

Photograph by F. T. Usher on a Wellington Anti-Screen Plate.
Reproduced from a print on Wellington Bromoil Paper.

Lantern Slide Making on Wellington Lantern and S.C.P. Lantern Plates.

IT has been said that the finest way to display a perfect negative is by means of a good lantern slide. A lantern slide is nothing more than a print on glass; but to allow of the slide being shown in the usual form of lantern, there is a standard size for lantern plates, namely, $3\frac{1}{4}$ inches square (in the United States the standard size is 4 inches by $3\frac{1}{4}$ inches). The consequence is, that unless the picture that we wish to make into a slide is on a plate not larger than a quarter plate, and does not occupy even the whole of that, the negative must be *reduced* on to the lantern plate.

Reduction is in no sense different from enlarging, except that in enlarging the distance between the lens and the Bromide paper is greater than between the lens and the negative, while in reduction the distance between the lens and the lantern plate is less than that between the lens and the negative.

When the picture on the negative is already of a suitable size, the slide can be made by contact printing, as with a piece of Bromide or gaslight paper.

Wellington Lantern Plates are made in two distinct grades, *viz.* :—

THE WELLINGTON LANTERN PLATE, which is intended for use in the dark room, and

THE WELLINGTON S.C.P. LANTERN PLATE, which can be handled in ordinary subdued artificial light, in the same way as the Wellington S.C.P.

Both grades are suitable for contact printing or reduction; but for reduction the Wellington Lantern Plate will be found the more suitable, although with a powerful illuminant, such as daylight or the electric arc, the S.C.P. Lantern Plate can be used with perfect success.

A valuable property of both these grades of lantern plates, and especially of the S.C.P. Lantern Plate, is that it is easy to vary the colour of the slide by increasing the exposure and modifying the developer in the manner described hereafter.

LANTERN SLIDES BY REDUCTION.

Before proceeding to describe the development of lantern plates, it is well to say something about making slides by reduction, because, although the process is very different from the contact method, the development and after-processes are the same, the difference being in the matter of exposure only. The simplest method of making slides by reduction is by means of a fixed-focus reducing camera. This has a holder at one end to take the negative, and another at the other end to take the lantern plate. Between the two is a lens. The whole arrangement is so fixed that the image of the whole of the negative is sharply focussed on the lantern plate of the required size. The camera, in the simpler forms, is taken bodily into the dark-room for the insertion of the plate, and is then carried out and stood on end in the open air so that the uninterrupted light of the sky may shine straight down through the negative. Needless to say, direct sunlight should be avoided. After an exposure, regarding the length of which no hint can be given, as it depends on the character of the negative, the strength of the light, the degree of reduction, and the stop in the lens, the camera is carried back and the plate developed. Other forms of fixed-focus reducing cameras are provided with a dark slide, so that it is not necessary to carry the whole apparatus into

a dark room for loading. Other lantern-slide cameras are so arranged that the negative can be focussed and any desired degree of reduction obtained.

Slides may be made by reduction without any special apparatus other than an ordinary camera provided with a carrier to take a lantern plate. The negative to be reduced must be fixed in front of an opening in a piece of wood or card, so that the surrounding light is cut off from the camera, and the negative is illuminated from behind. This may be done in daylight by fixing a white card, larger than the negative, at an angle of 45° behind it, and placing the whole arrangement where the light from the sky can shine down on the card. Or artificial light may be used. A paraffin, gas, or electric lamp with a big ground-glass globe makes an excellent illuminant for a quarter-plate, but with larger sizes something more elaborate is necessary to get even illumination. One of the simplest plans is to take two pieces of fine ground glass, an inch or two each way larger than the negative, and to fix them one inch apart from each other and the nearer one at least one inch behind the negative. Almost any illuminant can be used behind such an equalizer. Incandescent gaslight or electric light does very well, or magnesium ribbon may be burnt. In front of the negative the camera is set up, and the image sharply focussed on the screen to the required size. The lantern plate is then put in the slide and exposed.

It is well to note that the camera and negative should, preferably, be supported on the same board or table, to prevent independent movement, which would cause blurring. The focussing must be done very carefully, and if necessary the lens should be stopped down. There is no need to cover in the space between the lens and the negative, if the card which surrounds the latter is large enough to prevent strong light from shining into the lens.

DEVELOPING WELLINGTON LANTERN PLATES.

For cold tones, the hydroquinone developer described on page 37 or the metol-hydroquinone formula given below will be found

satisfactory. Used with these developers, the average exposure with Wellington Lantern Plates would be about four seconds at 36 inches from a 32-c.p. lamp.

METOL-HYDROQUINONE DEVELOPER.*

(Wellington Universal formula suitable for all Wellington Plates, Papers and Films.)

Metol	20 grains.	1 gramme.
Hydroquinone	60 „	3 grammes.
Sodium Sulphite (cryst.) ...	700 „	35 „
Sodium Carbonate (cryst.) ...	700 „	35 „
Potassium Bromide	6 „	0·3 gramme.
Water to	20 ounces.	500 c.c.

Dissolve in the order given, allowing each ingredient to enter completely into solution before adding the rest. For use, dilute with an equal part of water.

N.B.—All metol-hydroquinone developers should be used at a temperature of from 60° to 65° Fahr. Below 60° Fahr. hydroquinone rapidly loses its developing power, and at very low temperatures becomes practically inert.

In many cases, however, a tone warmer than that given by the above developer is preferable, and for this purpose the following pyro-ammonia developer is recommended :—

PYRO-AMMONIA DEVELOPER.

No. 1.

Pyrogallic Acid...	1 ounce.	50 grammes.
Sodium Sulphite (cryst.) ...	2 ounces.	100 „
Citric Acid	40 grains.	5 „
Water to	10 ounces.	500 c.c.

No. 2.

Ammonia ·880	1 ounce.	50 c.c.
Water to	10 ounces.	500 „

No. 3.

Ammonium Bromide	1 ounce.	50 grammes.
Water to	10 ounces.	500 c.c.

The single solutions keep well, but should not be mixed together until the developer is required for use. It is made by taking 30 minims of No. 1, 60 minims of No. 2, and 30 minims of No. 3,

* *This developer is obtainable in packet form.*

and adding one ounce of water (in metric measure, 30, 60, and 30 drops respectively may be taken to 30 c.c. of water). This developer gives warm black tones, the slides being developed in from two to two and a half minutes.

If the quantity of No. 3 is increased, the rest remaining the same, warmer tones are obtained, getting browner and browner as more and more of No. 3 is used. The exposure has to be increased at the same time, and the development takes longer. For decidedly warm tones the exposure may be as much as six times the normal, and the quantity of No. 3 increased to 90 minims or drops. Development in this case will take five or six minutes. The warmer the tone of the finished slide the lighter will be the colour of the image as it lies in the dish, and this may prove very deceptive. It is best, therefore, to get into the habit of timing the development to prevent under- or over-development. Haphazard additions of bromide should not be made, and, if anything like a fair proportion of the slides is to be successful, the photographer must make up his mind what tone he likes, mix his developer accordingly and stick to that developer until he is thoroughly familiar with it, making his exposures to suit that particular developer and no other.

The following developer, with Wellington Lantern Plates that have received from four to five times the normal exposure, will give rich sepia tones, development taking two and a half minutes.

PYRO AND AMMONIUM CARBONATE DEVELOPER.

A.

Pyrogallic Acid...	1 ounce.	27 grammes.
Sodium Sulphite (cryst.) ...	4 ounces.	100 „
Water to	20 „	500 c.c.

B.

Ammonium Carbonate ...	480 grains.	30 grammes.
Potassium Hydrate	360 „	22 „
Ammonium Bromide	240 „	15 „
Water to	10 ounces.	250 c.c.

One dram each of A and B are taken, and water is added to make one ounce (4 c.c. of each, to make 30 c.c. in all).

THE WELLINGTON S.C.P. LANTERN PLATES.

Most of the foregoing remarks apply equally to the S.C.P. Lantern Plates, except that with them no dark room is necessary and all operations can be carried out in a room illuminated by ordinary artificial light. Care should be taken not to expose the plates to strong direct light, but at about 8 feet from the illuminant, or screened from its direct rays, they can be handled with perfect safety.

The following developer is recommended :—

METOL-HYDROQUINONE DEVELOPER.*

(Wellington Universal formula suitable for all Wellington Plates, Papers and Films.)

Metol	20	grains.	1	gramme.
Hydroquinone	60	„	3	grammes.
Sodium Sulphite (cryst.) ...	700	„	35	„
Sodium Carbonate (cryst.) ...	700	„	35	„
Potassium Bromide	6	„	0·3	gramme.
Water to	20	ounces.	500	c.c.

Dissolve in the order given, allowing each ingredient to be completely dissolved before adding the next.

N.B.—All metol-hydroquinone developers should be used at a temperature of from 60° to 65° Fahr. Below 60° Fahr. hydroquinone rapidly loses its developing power, and at very low temperatures becomes practically inert.

With the above developer and a negative of average density the exposure at a distance of 6 inches from a 32-c.p. electric light will be about half a minute. If magnesium ribbon is used, ½ inch at about 18 inches from the negative will be found approximately correct. The tone obtained will be a particularly fine cool black. Development will take about 30 seconds.

Used in the above manner the S.C.P. Lantern Plate will be found particularly suitable for weak negatives, from which brilliant slides will be obtained without difficulty.

By increasing the normal exposure by about one-third, and adding potassium bromide to the developer, very beautiful warm black and cool brown tones can be secured. Two grains (20 drops

* *This developer is obtainable in packet form.*

of a 10 per cent solution) of potassium bromide to each ounce of developer will be found the best average proportion, but the quantity may be increased up to 20 grains if desired. Development with the addition of two grains of potassium bromide to the ounce will take about two minutes, the appearance of the slide as it lies in the dish being a reliable indication as to what its final density will be.

For decidedly warm tones the exposure must be considerably increased and the following restrainer added in the proportions indicated :—

Ammonium Carbonate	...	1 ounce.	10 grammes.
Ammonium Bromide ...	...	1 „	10 „
Water to	...	10 ounces.	100 c.c.

For rich brown tones one dram of this solution should be added to each ounce of developer, and the normal exposure increased by one-half. Development will take about one minute.

For very warm brown tones, two drams of restrainer must be added and the normal exposure increased from three to four times. Development will take from two to two and a half minutes.

As with the Wellington Lantern Plate, when ammonium bromide and ammonium carbonate are used as a restrainer the appearance of the slide as it lies in the dish is likely to prove misleading, and some method of timing should be adopted to prevent under- or over-development. If the worker adheres to the times given above, namely, one minute when one dram of restrainer is added and from two to two and a half minutes when two are used (the temperature of the developer being from 60° to 65° Fahr.), he will have little difficulty. If the results are too dense or too thin it is a sign that the exposure has been too long or too short, as the case may be, and another slide should be made. A slide that shows signs of over-exposure may be saved by shortening the period of development, and an under-exposed slide may be saved by prolonging development ; but in such cases the colour and gradation will be altered, and the slide may prove poor in quality. Correct exposure is a matter of judgment and experience, but, working by the above method, the photographer can always be sure

that his development is correct. If the results are not what he desires he will know that it is the exposure that is wrong, and can act accordingly.

It is, of course, quite possible to judge development in the ordinary way. If the worker decides on the tone he desires and suits his developer and exposure to that tone, a very little experience will show him just what a correctly developed slide looks like as it lies in the dish, and once this knowledge is obtained no slide need be spoilt through over- or under-development.

A warm-tone slide always gains in depth on drying and becomes colder in colour. When taken from the fixing bath, a slide developed to a very warm tone will present a somewhat washed-out appearance. This, however, should not disturb the worker, as a gratifying improvement will be apparent on drying, the slide gaining in richness and density.

WELLINGTON BORAX-M.Q. DEVELOPER.

The Borax-M.Q. formula, which has already been referred to in the chapters on Plate Development and the Development of S.C.P. (see pages 26 and 85), can be used with very satisfactory results with the Wellington S.C.P. Lantern Plate.

The addition of one drop of a 10 per cent. solution of potassium bromide to each ounce of solution is necessary to ensure freedom from fog. In colour the image will be a slightly warm black, and softer in contrast than that obtainable in the metol-hydroquinone developer previously given.

By increasing the exposure from two to three times and adding 10 drops of a 10 per cent. solution of potassium bromide to each ounce of developer, very pleasing brown tones will be obtained. Development will take from two to three minutes.

FIXING, WASHING AND DRYING SLIDES.

When the lantern plate is taken from the developer it should be well rinsed in water and then fixed in a plain solution of hypo (four ounces of hypo to 20 of water), or preferably in either the Acid

Fixing Bath or the Combined Hardening and Fixing Bath given on pages 65 and 67.

It should be left in the fixer until the whole of the white appearance has gone from the back and for as long again. It is then taken out and washed in the same way as a negative. Before being put to dry, it is well to rub the film very gently with a tuft of cotton wool, while holding the plate under the tap. This gets rid of any deposit from the water. The slide can then be dried.

It is more important to dry a slide where dust cannot get at it than it is so to dry a negative, as in the negative fine dust may be quite unnoticed, but in the slide it is magnified on the screen and becomes very obvious.

MOUNTING LANTERN SLIDES.

When dry a slide has to be masked, mounted, and spotted before it is ready to be shown in the lantern. Masks of black paper can be bought, ready cut ; but as this means that the picture must be made to fit the mask, it is better to use the plain gummed strips which are sold for binding slides. These are merely wetted and laid down on the film side of the slide so as to block out everything that is not to be shown on the screen. With a little care it is easy to keep the corners quite square and true. Some pieces of clean glass $3\frac{1}{4}$ by $3\frac{1}{4}$ inches will be wanted for cover glasses. Any spoilt lantern plates should be kept for this purpose, the film being cleaned off with hot water and a stiff brush.

Before binding up a slide it should be thoroughly dried in front of the fire. Then the cover glass is placed on it, and the two stuck neatly together, by binding round the edges with the gummed strips sold for the purpose.

It is now only necessary to " spot " the slide. Spotting is done to show which way the slide is to be put into the lantern. Small round white spots, which may be cut out of paper, are stuck on the slide, so that when the slide is looked at in the hand, and the picture is seen the right way round, the spots are at the two top

corners facing the worker. The lanternist then knows that if he puts such a slide into the lantern with the spots downwards and towards the light, the picture on the screen will be the right way up and the right way round.

REDUCING LANTERN SLIDES.

It is sometimes necessary to reduce a developed lantern plate which has been made too dense. The following solution will be found very convenient for the purpose. It is also useful for removing any tint on the sky which may seem undesirable, or for any other local reduction that may be needed. The reducing solution is made of :—

Potassium Ferricyanide ...	120 grains.	7 grammes.
Water to	20 ounces.	500 c.c.

A dram or two of this (3 to 6 c.c) are added, just before use, to each ounce (30 c.c.) of ordinary hypo solution. The plate is immersed in the reducer, when it is to be acted on all over, or, if local reduction is required, the solution is applied with a small tuft of cotton-wool or a camel-hair brush. The plate, after reduction, is well washed and dried.

PRINTING CLOUDS INTO LANTERN SLIDES.

The operation of printing clouds into lantern slides, although not easy to describe, is by no means difficult in actual practice. Two methods are at the disposal of the worker : he may print the clouds on to the same plate as the landscape, or he may print them on a separate plate, and bind this up film to film with the landscape so as to form a cover glass.

If it is desired to print the clouds on the same plate as the foreground, it is first necessary to cut two masks—one to cover the sky while the exposure of the landscape is being made, and the other to cover the landscape while the exposure of the sky is being made. This is best done in the following manner :—

Take a piece of P.O.P. and cut it exactly to the size of a lantern plate ($3\frac{1}{4} \times 3\frac{1}{4}$). Place this on the landscape negative so as to include just the portion that is to be used for the slide, and, with a finely pointed lead pencil, mark the exact position of the corners on the film of the negative. Now print until the horizon line is distinctly visible, and then neatly divide the paper along this line with a sharp knife or a pair of scissors. The two pieces of paper are then allowed to darken by exposing them to the light.

Take the sky portion and, with a touch of gum or seccotine, attach it, emulsion side up, to the glass side of the landscape negative, so that it exactly covers up the sky, taking care that the two top (*i.e.*, square) corners exactly coincide with the pencil dots on the film of the negative. If the mask curls away a little along the divided edge, so much the better, as it will help to soften the skyline when printing.

Now take the second or landscape mask, and attach this, emulsion side up, to the glass side of the cloud negative, marking the position of the two square (*i.e.*, uncut) corners on the film of the cloud negative with a lead pencil, as before. The cloud negative is now placed in the printing frame, a lantern plate adjusted over it so that two corners exactly coincide with the dots previously made, and the exposure is given. The cloud negative is then replaced by the landscape negative, the lantern plate adjusted so that its four corners correspond with the four pencil dots, and the exposure for the landscape is made. To avoid the mistake of printing clouds and foreground on the same half of the slide, it will be as well to mark the top of the lantern plate, after the first printing, before it is taken away from the cloud negative, with a small piece of black gummed paper. It is a good plan to move the frame gently during both exposures so as to soften the skyline and prevent a hard junction showing.

When two plates are used, one for the clouds and one for the foreground, the procedure is exactly the same, except that after printing the clouds or the landscape, as the case may be, instead of returning the same plate to the printing frame another is used.

For this method, however, it will be necessary to mask the cloud negative with the P.O.P. mask, emulsion side down.

The principal advantage of this cover-glass method is that either the landscape or the sky may be reduced in the manner described on page 128 if found to be too dense, and the sky, if accidentally printed so as to overlap the landscape, may be locally reduced with the same reducer applied with a camel-hair brush.

Whichever method is used, care should be taken that the sky in the finished slide is lighted from the same direction as the landscape, or an effect such as was never seen on sea or land will be the result. In this connection it is important to note that if the two-plate method be adopted the sky will be reversed from left to right, so that a negative of a sky lit in the opposite direction to that of the landscape with which it is to be combined must be chosen.

BRANDON LODE

Photograph by Bertram Cox on a Wellington Anti-Screen Plate.
Reproduced from a print on Wellington Bromoil Paper.

The Bromoil Process.

FOUNDED on the Ozobrome process of Thomas Manley, Bromoil has developed through the efforts of a group of enthusiastic workers into a recognised photographic process of unsurpassed value for pictorial work.

The theory is simplicity itself: A gelatine surface possesses the power of taking or repelling a greasy ink in proportion to the amount of water it holds. Accordingly an ordinary Bromide print is taken and the image bleached so that it is converted from a visible deposit of silver into plain gelatine with a greater or lesser power of absorbing water. The Bromide print thus treated is soaked in water, blotted off, and pigment applied by means of a brush. *In inverse proportion to the amount of water absorbed by the soaked Bromide print* (which in turn is inversely proportionate to the original image) *the pigment is taken by the gelatine,* so that the original silver image is finally converted to one of oil pigment.

It may be asked, "What are the advantages of turning a Bromide print into a Bromoil?" The answer is, firstly, that when applying the pigment a great deal of control can be exercised and the final result modified according to the worker's desire; secondly, the resultant picture, consisting as it does of oil pigment, is as permanent as an oil painting; and, thirdly, a Bromoil print has a soft, glowing richness peculiarly its own.

THE ORIGINAL BROMIDE PRINT.

It is immaterial whether the original Bromide print is made by contact or enlargement. It must be a good one in every way, correctly exposed, and fully developed. It is no good to say, "Oh, here's a poor thing, better bromoil it." True, an expert can work wonders in Bromoil, but nothing can make good deficient technique in the original. The Bromoil worker will, therefore, do well to study attentively the chapter on Bromide Printing in the earlier part of this book. The ideal print for bromoiling should be brilliant, but never hard: and should possess every detail throughout the whole scale of gradation.

In theory any Bromide paper may be used for Bromoil, but it will be found in practice that the special grades of WELLINGTON BROMOIL PAPER offer advantages over all others. Wellington Bromoil Paper is made in four grades:—

White Smooth (double weight). White Rough (double weight).
Cream Smooth (double weight). Cream Rough (double weight).

BLEACHING THE PRINT.

If a Bromide print is immersed in a copper bleaching bath which contains chromium, the silver image, as it disappears, will tan the gelatine proportionately to the original image. Where the silver deposit has been heaviest, namely, in the blackest portions of the original picture, the tanning will be the most thorough; where the silver deposit has been slightest, the tanning action will be the least and all the intermediate gradations will be represented by intermediate degrees in the tanned condition of the gelatine. On soaking such a print in water the most thoroughly tanned portions, *i.e.*, the deep shadows, will absorb the least amount of water, while the least tanned portions, *i.e.*, the high-lights, will absorb the greatest, intermediate gradations absorbing intermediate proportions. When an oil pigment is applied it will be received by the gelatine in inverse proportion to the amount of water contained, *i.e.*, least in the

high-lights, where there is most water, and most in the shadows, where there is least.

The Bromide print having been fixed in a plain (not an acid) fixing bath, and washed, must be bleached. It is important that no attempt be made to harden the film by alum or formalin, otherwise it will not pigment easily.

It may be bleached wet, as soon as the fixing and washing operations are concluded, or equally well the dry print may be immersed, only in this latter case it is important that it be passed into the bath with a steady, even sweep. Should there be any hesitancy, lines of unevenness will form which cannot be removed. Hence it is important to use a large quantity of solution.

There are many good commercial bleachers on the market, but the following works well and has the advantage of being cheap :—

STOCK SOLUTION.

Copper Sulphate	2 ounces.	80 grammes.
Potassium Bromide	2 „	80 „
Potassium Bichromate ...	50 grains.	4·2 „
Sulphuric Acid	40 minims.	3·3 „
Water	25 ounces.	1 litre.

Add the acid to the water first, which, to facilitate the dissolving of the various ingredients, should be warm. For use, take one part of this stock solution to three parts of water. A print immersed in this bath at a temperature of 65° Fahr. will bleach entirely in three minutes. After bleaching a batch of prints, pour the bleacher back into any convenient large receptacle for future use. Should it after a time commence to bleach slowly, merely add sufficient stock solution to bring the bleaching period once more to the three minutes, which may be regarded as the standard time for this purpose. The addition of 20 minims of a saturated solution of potassium bichromate to each ounce of bleacher slows the action but increases the tanning power. The addition is recommended when a print is intended to be inked up without intermediate drying.

After bleaching, wash the print for one hour in running water or in many changes. This washing must be thorough, or markings due to irregular tanning will be produced.

In this state the print still contains all the original silver, and, of course, if desired it could be redeveloped. To prevent future discoloration it is, however, desirable to remove the silver image entirely, and this is done by fixing for ten minutes in a hypo fixing bath, three ounces of hypo to 20 ounces of water.

After fixing, a wash of 15 minutes is sufficient. Any faint trace of hypo remaining in the print will do no harm, as there is no silver left to attack and the hypo is without effect on the pigment used to build up the image.

A SHORT CUT IN PREPARING THE PRINT.

The above is the orthodox method of preparing the print for pigmenting, but where prints are definitely intended for the Bromoil process it is possible to bleach them after development and *before fixing*. Prints must not at this stage be exposed to white light. A wash of 10 minutes is sufficient to remove the developer preparatory to bleaching—any faint traces remaining are apparently without influence. If a number of prints are being prepared they may be placed in running water till the whole batch is completed, when a final wash of 10 minutes will prepare them for bleaching.

From this point onward the bleaching, washing, final fixing and final washing are carried out exactly as previously described.

The bleached, fixed and washed print must now be dried.

It must be pointed out that in all stages it is imperative to preserve the mechanical integrity of the gelatine. A blistered surface for instance, renders work on the print impossible. A sharp fold or scratch on the surface is also fatal to success. A considerable amount of care must also be taken as regards drying the bleached print ; it must not be hung over a line to dry—quite an ordinary method as regards a Bromide print. As far as Bromoil is concerned, to dry a print in this manner spells disaster, for in such a case the

gelatine immediately over the line dries under a greater tension than the rest, due to the sharp bend caused by the weight of the print. The best way to dry prints is to pin them by one corner to the edge of a shelf or table, or alternatively to hang them from a line by a clip. Care must also be taken to blot off all adherent globules from the surface of the print ; if these are allowed to remain, the gelatine under them dries at a much slower rate than the rest of the surface, causing a mechanical alteration in the gelatine which makes itself apparent on pigmenting in the form of spots always several tones lighter than the surrounding portions of the print.

THE BROMOIL BRUSHES.

Before dealing with the question of pigmentation, or " inking up " the print, some consideration may be given to the tools used in the process. The most important, naturally, are the brushes. The brush is formed in the shape of a horse's hoof, and the favourite hair in the past was the well-known and beautiful hair known as " fitch " (or pole-cat). This hair is certainly well adapted to the process, and its use is still imperative for small, finely finished work. Unfortunately, brushes made from this hair have since the war become very rare, and when obtainable at all are extremely expensive.

Luckily for Bromoil workers, another alternative is presented in the brush made from hog hair, of which the use has been somewhat neglected in the past, though it presents many advantages. Firstly, the brushes are very cheap, the largest size, a No. 4, of French make, at the present time will cost about 12s. 6d. A much better brush of the same size but of English make costs 18s., and incidentally is well worth the additional cost. Another advantage of the hog-hair brush is that, owing to its great stiffness, it can deal with the hardest ink without the least difficulty. As the brush holds the hair exceptionally well, the work always keeps very clean, a point of great importance when, in the fulness of time, the bromoilist essays transfer. The sole disadvantage attached to the use of this brush

is that it gives a somewhat coarse grain to the print, which, so far as large prints are concerned, is a matter of small moment. It can easily be remedied, in any case, by gently going over the print with a small fitch brush to close up the grain.

It should be pointed out that a hog-hair brush, as bought, is generally too hard, but to bring it to a proper working condition it is only necessary to wash it under the cold-water tap with a little soap, afterwards allowing it to dry at the natural room temperature. Afterwards brushes may with advantage be cleaned with a little Benzine, taking care to be right away from a fire or flame of any kind.

For the encouragement of the beginner, it may be stated that while large brushes are necessary for big work, they are not essential for such sizes as whole plate and 10×8. A useful brush for a start on these sizes can be obtained for a few shillings.

THE PIGMENTING PAD.

As the print has to be kept in a thoroughly moist condition during operations, the next step is to prepare a pigmenting pad. This is quite a simple affair, merely consisting of a sheet or two of damp blotting paper. A solid base should be provided for the wet pad, and for this nothing is better than a slab of slate about an inch in thickness. A sheet of strong glass will do quite well. A safe edge must be provided to keep the brush from touching the over-wet surface of the pad. For this it is only necessary to take some old roll films from which the emulsion has been removed, and lay them on the pad, forming a rectangle of such a size that the print overlaps the area so enclosed by about half an inch all round. In the alternative, strips of waxed paper are simple and effective in use.

THE PIGMENT.

The inks used in Bromoil work are similar in all respects to those used by artists in oil-painting, except as regards consistency.

In the past, pigments for Bromoil purposes have been supplied in one consistency only, namely, of a medium thickness. They can now be obtained in two thicknesses, or consistencies, for each colour, extremely hard and very soft. The reason for this will be apparent later.

Bromoil work has been rendered more difficult in the past, owing to the provision of a single ink only. If we consider for a moment the condition of a print as prepared for bromoiling, it will make things a little clearer. We have a print in which the image is represented by gelatine in a more or less tanned condition. If we apply a pigment to the surface of this print whilst it is still in the dry condition, it will, of course, take all over quite impartially and regardless of the consistency of the ink, because, owing to the absence of water, no part of the gelatine can exhibit any selective action on application of the pigment.

SOAKING.

Now, instead of inking on the dry print, let us soak it in water, which preferably should be cool, certainly not warmer than 65° Fahr. After allowing it to soak for three minutes, it will be found that the print lies quite flat in the dish. The print is still capable of absorbing a great deal more water, but at this point it is removed and laid face upwards on the pad and the surface moisture removed with a piece of blotting paper. As the print holds so little water, it is receptive to a very thick ink, much thicker than could be used if the print had absorbed the maximum amount of water possible, because a thick ink must hold, for its bulk, far less grease than a thin ink. A trial touch or two on the surface of the print with a suitably charged brush proves this immediately : the image appears instantly, as at the touch of a magician's wand. Suppose, on the contrary, we approach the print with a brush charged with a very soft ink : as one would expect, the ink takes to the print with almost equal facility in all parts, giving an extremely flat result.

It has been necessary to labour this point, as most of the Bromoil failures of the past have been due to a lack of appreciation of the extreme significance of the water content of the print, or rather of the gelatine film. It should never be forgotten that the less water in the print the harder the ink must be, and the more water the softer. Until quite recently, to ensure the proper water content of the print the greatest nicety of judgment has been called for on the part of the operator. Having a pigment of one fixed consistency only, he has been compelled to soak the print in water at a temperature and for a period which experience has shown him to be suitable for the particular ink employed. To put the matter in plainer terms, the problem has always been approached the wrong way about: the operator has tried to suit the water content of the print to the pigment, always a matter of great difficulty, instead of suiting the ink to the water content of the print, a far simpler procedure.

PIGMENTING.

It is now possible to proceed with the actual pigmentation of a print. A palette of some description is necessary for the colours used; an old piece of thick glass is very good, but, if it can be obtained heavy enough, a piece of opal glass is better. Whatever the style of the palette, care must be taken to adopt some definite system in the arrangement of the colour. Take a little of the hard colour from the tube, and, using an old table-knife, spread it out as thin as possible on the upper left-hand corner of the palette, allotting the upper right-hand corner to the soft ink, which must also be spread out with the aid of the knife into an extremely thin film.

The dry print having been immersed in cool water, as already described, for a period of ten minutes, is laid on the pad and the free surface moisture removed with a piece of fluffless blotting paper or a soft, clean linen rag. If all is well, on looking at the print from a glancing angle the image can be seen showing up as a delicate matt impression on the surrounding glossily wet gelatine.

With one of the hog-hair brushes some colour is taken from the hard patch of ink on the palette, and on the centre of the palette a thin, even film of this hard colour is worked up with the brush ; this central patch forms what may be termed the working patch. As soon as a good, even patch is prepared, the print can be approached by the brush, choosing a locality where there is deep shadow. At the first touch of the brush the image instantly springs into view, and the building up of the whole image in accordance with the artistic feeling of the operator is only a matter of time. If, however, the print refuses the ink a touch of softer ink may be worked into the hard ink. Presently the right degree of quality will be found and the work can be proceeded with.

A common failing of the beginner is timidity in applying colour. Do not be afraid, at all events in the early stages, of applying it freely. Get the print covered as quickly as possible ; and though the high-lights may at first be filled up and muddy, they will clear up as the work progresses, the ink gradually leaving the lighter tones of the picture and settling on the shadows, the print serving in a sense as an additional palette. It should be remembered that a certain brush action is necessary to get the colour on evenly and well, and, unfortunately, the correct action is one which only experience or demonstration by an experienced operator can teach. It is in no sense the usual painting stroke, neither is it exactly a dabbing action ; it is more in the nature of a quick, firm pressure combined with a slight dragging action at the moment of impact. An hour spent on inking up a print of no value, using different strokes of the brush, will teach the learner more of the correct action than could be possibly learnt from the pages of a book.

As soon as the print has gained sufficient depth, a few moments may profitably be spent in inspecting it, to decide the course of further operations. If the original print was all that it should have been, every detail should now show in all parts of the image. The texture may be somewhat coarse, due to the use of the hog-hair brush. In a large print this may not be unpleasing ; but if it is objected to, all that is necessary is to take a small fitch brush initially

charged with a microscopical amount of colour, and go gently over the print again. No more colour is added to the image, but unless a certain amount of colour is on the fresh brush it will at first remove some of the colour already deposited on the print.

It may be that the print will work up deficient in detail, or somewhat hard. In such a case, the colour must be softened further. Touch the patch of soft colour lightly with the brush and work it well into what has been termed the "working" patch. On again trying the print the colour will be found to take much more readily on the lighter portions. By taking additional minute proportions of the soft colour, and working them into the working patch, the hard ink can be softened to any extent, and the consistency of the colour adjusted to the water content of the print, no matter what this latter may be.

Sometimes, particularly during the heat of summer when evaporation proceeds freely, the print works up very flat even with the dead hard ink, this flatness only increasing with continued work. This is caused by the loss of water from the film. To remedy this, plunge the print for half a minute into water at the original soaking temperature, and after blotting off, recommence work, but without adding further colour. The brush will remove the colour from the lighter portions of the print and transfer it to the shadows, restoring at once the brilliancy of the print. This process may be repeated as often as necessary, care being taken not to add more colour until the print has regained brilliance.

CONTROL.

It is clear that during the process of inking up, or pigmenting, a great deal of control is possible. The margins of landscapes may be toned down, and the irritating high-lights caused by gaps in foliage filled in. This is done by going over the portions in question with a brush charged with very soft ink. An impression of clouds may be given to a bald sky, but this demands knowledge and skill, and it is better to print the clouds into the original by one of the

methods described in the chapter on Enlarging. The operator, until he has gained experience and always unless he possesses artistic ability in a marked degree, should attempt control sparingly.

A handy tool, the correct use of which should be early acquired, is the hopper. This may be bought ready made or constructed out of a bicycle spoke with a spiral loop at one end and a handle at the other. Into the loop a small fitch brush is forced, and holding the hopper by the handle it is possible, thanks to the elastic nature of the wire, to impart a rapid vibratory action to the brush so that it taps lightly on the surface of the print. This action with the dry brush has quite a wonderful effect in clearing up high-lights and revealing hidden detail.

Less legitimate possibly is the use of the short, stiff hog-hair brushes as used by painters. These are used dry to remove small, sharp touches of colour and thus create high-lights as the fancy of the operator may dictate. They are also of use in hatching a background in portraits—to silhouette a head, for instance. Care must be taken to wipe these brushes on a piece of rag after each stroke, or smudges will result. A small piece of rag, or a tiny sponge forced in the end of a glass tube and moistened with petrol is a very efficient tool when it is desired to make a wiped or ragged vignette of a portrait.

The Bromoil worker should studiously avoid attempting control without a clear idea of the effect aimed at. It is an excellent plan to prepare in advance a small guide print, roughly indicating on this in pencil the modifications it is desired to introduce into the finished print.

DRYING AND MOUNTING.

The finished print is apt to prove somewhat erratic in drying, depending to a large extent on the depth of the inking. The use of very soft ink will delay drying. In a steady temperature of about 100 degrees, prints should be dry enough for mounting in about four days.

Any of the usual mounting methods may be used provided the print is not wetted. If paste-mounted, it may be damped on the back with a sponge. If dry mounted, too high a temperature must be avoided, and no attempt must be made to dry-mount a print until it is thoroughly dry and the surface well set.

A considerable amount of work can be done with advantage on the dry and mounted print. It must, of course, be spotted in the usual manner. A hard rubber may be used in touching up defective high-lights, and any slight unevenness, in the sky for instance, may be removed by very gently rubbing the print with a finger-tip over which the corner of a handkerchief is tightly stretched. The appearance of the print is also vastly improved by a general light polishing action with a pad made with an old silk handkerchief wrapped round one of the velvet pads familiar to those who wear silk hats.

Such is an outline of the method, adopted with success by the writer, of making Bromoil prints. It is the reverse of the hitherto universal method of immersing the print in water of high temperature. Its success depends on suiting the ink consistency to the water content of the print, a far simpler problem than suiting the water content of the print to any one ink.

There is no necessity to heat up solutions. The new Wellington Bromoil Paper will work well with water at room temperature, say, 60° Fahr., and the use of higher temperatures is not advised. Worked in cool solutions the gelatine is preserved in a condition of greater mechanical strength, and so is best fitted to withstand the most vigorous brush action—a point of some importance when hog-hair brushes are used.

BROMOIL TRANSFER.

The bromoilist, as his manipulative skill increases, turns his thoughts towards transfer. The transfer process is unqestionably a queen among photographic processes; but it is one of such difficulty, and such knowledge and patience are required for successful work, that it is impossible here to do more than

STILL LIFE STUDY

Photograph by F. T. Usher on a Wellington Anti-Screen Plate.
Reproduced from a print on Wellington Bromoil Paper.

outline it. It gives the worker complete independence as regards the base ; a rough, smooth or tinted base may be used entirely at the worker's option. Again, as there is no shiny gelatine substratum under the image, the transfer has a matt surface of great delicacy and beauty, giving it the appearance of a fine aquatint. By repeated transfers on to the same base the image may be built up exactly as desired, either as a whole or locally, thus giving a control more absolute and effective than in the direct Bromoil process.

In the transfer process we have to transfer the pigment image from the original photograph to another base ; it is evident therefore, that the photographic original must be reversed. As the pigment has to leave the original base for a new one, it is wise to soak the bleached print well and use a softer ink. The presence of a large quantity of water in the print naturally makes it easier for the greasy pigment to leave the original and cling to the fresh base.

The routine as regards the pigmentation is exactly as already described, the utmost care being taken to keep the work exceptionally clean. Quite a rough inking, provided it is strong enough, will suffice for the first transfer, because the first pull from a Bromoil print in making a transfer is rarely a success. All the pigment will leave the lighter tones of the original, whilst a considerable amount will remain on the shadows, giving the first transfer a shockingly flat appearance. This fact is so well-known that the expert never thinks of using a good piece of paper for making the first pull.

The following is the procedure recommended. Some form of press is necessary. Provided that the rollers are in good condition, the domestic mangle is quite an efficient instrument. An ideal press for the purpose, when it is obtainable, is the well-known Globe enameller, used in the dark ages of photography for imparting a fine gloss to the surface of the mounted print. Dealers even at the present day occasionally have some of these on their hands. If one can be obtained, the gear wheels connecting the two rollers must

be removed, leaving the upper roller quite free to revolve independently of the lower.

A pair of thin zinc plates are also required ; these should be a trifle wider than the paper forming the base for the transfer, and preferably should be longer by four or five inches. The plates should be firmly riveted together along the end, forming a book-cover kind of construction between which the print can be slipped.

As soon as the print is inked up, a piece of the transfer base is taken (this being the preliminary rough pull, the back of a previous failure can be used), laid upon a couple of pieces of soft blotting paper, and then the inked-up print is placed upon it in the desired position. It is then covered with two more pieces of blotting paper, and the whole " sandwich " is inserted between the zinc plates and passed between the rollers of the press, at first with a very light pressure. It should be passed through the rollers three or four times, the last time with the greatest pressure possible, and then the plates are opened to remove the print. This preliminary rough pull having been discarded, the bromide print is laid on the bottom of a dish under a running tap and well cleaned with a soft sponge, which, to facilitate the removal of the pigment, may be soaked in petrol. The print is then re-inked with every care, trimmed, and the process detailed above repeated with a view to producing the finished transfer.

Before stripping the original print from the transfer, reference marks must be made on the back of the print and continued over the edge to the transfer paper. The usual marking is a short line commencing on the print and finishing on the transfer paper. When the print after leaving the press and on being returned to the transfer paper, after re-pigmenting, is laid down, the marks referred to must register accurately. After making these reference marks, a steady pull on one corner of the print will bring it away from the transfer.

The first pull will probably be somewhat flat, due to a general weakness in the darker tones of the picture, as in these localities a considerable amount of the pigment usually fails to transfer.

If the half-tones and high-lights are satisfactory, the print is again thoroughly cleaned under the tap, and re-inked in the regions where the transfer lacks sufficient depth. The image is again transferred, using the reference marks on the back of the print to place it correctly on the transfer. After passing through the press, it will be found to have gained considerable strength, and naturally this process may be repeated as often as necessary to obtain the desired result.

Such is the skeleton outline of the transfer process. As already mentioned, it is a process of some difficulty, and should only be attempted when a full and expert knowledge of the Bromoil process has been acquired. The beauty of the results obtained makes it well worth the amount of application necessary to ensure perfection.

Chemicals.

THE nature and the purity of the chemicals used for photographic purposes have a very great influence upon the quality of the results obtained, an influence which many photographers do not fully appreciate. In the case of some of the chemicals employed, there is also a risk that, owing to the rather loose way of naming them, there may be a misunderstanding as to the precise substance that is meant. To guard against both these risks as far as possible, the following list, which contains most of the chemicals referred to in the foregoing notes, arranged in alphabetical order, has been prepared. Against each such particulars as it is desirable that the photographer should know have been given.

Where it is stated that a substance keeps well, it is assumed, unless the opposite is stated, that it is kept in a properly stoppered bottle. Even hypo keeps better in a corked jar than loose in a paper bag.

When preparing solutions it is important to see that all the ingredients are completely dissolved. Minute particles of amidol, metol, &c., undissolved in a developer cause black spots. Fine particles of developer dust, pyro, metol, amidol, &c., floating in the air of the work-room also give rise to spots if they settle on any sensitive plates or paper.

All Wellington chemicals are tested for photographic suitability before being placed on the market. They may be relied upon to be of the highest quality obtainable, and the worker can employ them with absolute certainty that none of his results will suffer by their use.

ALUM.—The word " alum " by itself generally means potash alum. It is sold in crystals or in powder form. As this substance dissolves sparingly in water it is advisable to use hot water when making it into a solution.

Chrome Alum is a deep purple crystalline salt. Its solution is purple by reflected and reddish by transmitted light. It exercises a more intense hardening action than potash alum.

AMIDOL (or Diamidophenol).—This reducing agent possesses the characteristic that it will develop without the addition of alkali. It should be in the form of a white crystalline powder. Even when made into solution with

sulphite it does not keep well. It should, therefore, be used within three days of mixing.

Ammonia (also called liq. amm. fort., or ·880 Ammonia, the ·880 referring to its specific gravity).—This chemical as known to photographers is a solution of ammonia gas in water. It must be kept in stoppered bottles as the gas is freely evolved at normal temperatures, the solution naturally becoming weaker. Care should be taken not to inhale the fumes, which are extremely irritating.

Ammonium Bromide.—Used in photography as a restrainer. This should be in the form of a coarse white powder. Keeps well both solid and in solution.

Ammonium Carbonate (also known as carbonate of ammonia and lump ammonia).—This should be in the form of tough waxy-looking white lumps, with not more than a slight coating of white powder on the outside. A little extra should be allowed when weighing out and the white powder rinsed off. Ammonium carbonate does not keep very well, either solid or in solution, and neither should be used if kept more than three months.

Ammonium Sulphocyanide (sulphocyanide of ammonia, ammonium rhodanate).—Small wet-looking crystals, chiefly used in photography in the preparation of gold-toning solutions. Keeps fairly well in bottles with tight-fitting stoppers, but liable rapidly to absorb moisture from the air, the result being a wet mass. It is desirable to dissolve the entire contents of the bottle in cold water, adding water until the bulk of the solution is ten ounces for every ounce of the sulphocyanide crystals dissolved. In the foregoing formulæ ten minims of this solution can then be substituted for each grain of the sulphocyanide prescribed. This solution keeps well.

Citric Acid.—Sold both in powder and crystals. Keeps indefinitely.

Copper Sulphate (otherwise blue vitriol or sulphate of copper).—Clean-looking deep-blue crystals, chiefly used in photography in the preparation of bleaching or toning solutions. It keeps perfectly in the solid form. In solution it gradually goes cloudy in appearance, but this does not interfere with its use. Hot water may be used to dissolve it.

Ferric Ammonium Citrate.—The best variety for photographic purposes is sold in the form of green scales, but the brown variety may also be used. It keeps well in the dry state.

Gold Chloride (otherwise chloride of gold).—This salt is sold sealed up in glass tubes, each containing fifteen grains. As only a grain or two is wanted at a time, and it is not convenient to weigh out such small quantities, it is best kept in solution in a stoppered bottle. The tube, having previously been freed from any adherent labels, is dropped into the bottle or measure, and broken either by shaking or by striking with a glass rod. Fifteen drams of distilled water are then added and the solution is ready. If the tube is broken in the bottle which is to contain the solution, the fragments of glass may be allowed to remain ; they will do no harm. As the fifteen drams of solution contain fifteen grains of chloride, each dram of the solution contains a grain, and in any of the preceding formulæ where one grain or two grains of gold chloride are prescribed, one dram or two drams of this solution may be used instead. Thus prepared, gold chloride solution keeps indefinitely. Impurities in the water may spoil it, which is indicated by a black sediment

settling down at the bottom of the bottle. It is for this reason that the use of distilled water is recommended.

Hydroquinone (sometimes called quinol).—This is sold in tiny needles or crystals of a greyish-white colour. In the solid form it keeps well.

Hypo (sodium hyposulphite, hyposulphite of soda, sodium thiosulphate). —This should be in the form of clear transparent crystals or a coarse white powder, and free from smell. It keeps indefinitely both in solid form and in solution, and readily dissolves in hot or cold water. As the dissolving of hypo cools the solution very greatly, warm water should be used, or the solution prepared some time before it is required, in order that it may regain a normal temperature. If this is not done, fixing may be very sluggish and blisters may be caused.

Iodine.—Appears commercially in the form of bluish-grey lustrous scales. It should be kept in a stoppered bottle. It stains whatever it touches brown, but the stain can be removed with a little sodium sulphite solution.

Lead Acetate (or sugar of lead).—A coarse white powder, very poisonous. It is soluble in water, yielding a somewhat milky solution.

Metol.—This is a white crystalline powder, soluble in water. In the solid form and in solution with sodium sulphite, &c., it keeps well.

Nitric Acid.—A colourless fuming liquid. Being very corrosive it should be kept in a stoppered bottle.

Potassium Bichromate(also called red chromate of potash and potassium dichromate).—Appears commercially in the form of fine orange-red crystals. It keeps well both in the solid form and in solution.

Potassium Bromide (otherwise bromide of potash).—This should either be in the form of a pure white powder or crystals. It is very soluble, keeps well in the solid state or in solution.

Potassium Carbonate.—This is a coarse white powder, which must be kept in a well-corked bottle, or it will absorb moisture from the air, cake hard, and finally turn liquid. In solution it keeps well, but its solutions should not be put in stoppered bottles, as it makes the stoppers stick.

Potassium Citrate (otherwise neutral potassium citrate or citrate of potash).—This is a granular white powder, very soluble in water.

Potassium Ferricyanide (red prussiate of potash).—This salt is sold in ruby-red crystals, which should be clear and bright. It must not be confused with potassium ferrocyanide, yellow prussiate of potash, a salt which occurs in large lemon-yellow crystals and is seldom used in photography. The ferricyanide keeps well in solid form, and fairly well in solution, but this depends largely on the purity of the water used to dissolve it.

Potassium Hydrate (caustic potash).—This is sold in white, hard sticks. It must be kept in well-corked bottles as the chemical absorbs moisture rapidly. Solutions of potassium hydrate should not be kept in stoppered bottles, as they make the stoppers stick. It keeps well in solid form and in solution.

Potassium Iodide.—This salt is sold in the form of white powder or crystals. It is readily soluble in cold water, and keeps well both in the solid form and in solution.

Potassium Metabisulphite (sometimes called metabisulphite of potash).—This salt should take the form of small, sharp-angled crystals, generally with a slight coating of a white powder upon them. This powdery layer should not go very far into the crystals, and may be removed by washing, as described under the head of sodium sulphite. It is not very soluble, and should be dissolved in cold or tepid water. Hot water drives off some of the sulphurous acid, as can be smelt, and this is the active part of the salt from the photographer's point of view. It keeps fairly well in a properly corked or stoppered bottle, both in crystals and in solution.

Pyro (pyrogallic acid or pyrogallol).—This is sold in a fine, snow-like powder, and also in large or small crystals. The powder dissolves most readily, but the crystals are more easily weighed out. Pyro keeps indefinitely in the dry form, and for a considerable period in solution if sulphite or metabisulphite is present. Its solution goes darker with age, and when very dark is useless.

Silver Nitrate.—The quality known as recrystallized should be used, and should be in the form of transparent flat-shaped crystals, with little or no white powder amongst them. Silver nitrate keeps very well in solution or in the solid form. When dissolved in ordinary water there is usually a slight cloudiness formed, but this can be ignored.

Sodium Bicarbonate.—This salt is used in photography to neutralize acidity in the gold chloride solution and in the hypo solution used for self-toning paper.

Sodium Carbonate (must not be confused with the bicarbonate).—This is usually met with in the form of dry, glassy crystals. The crystals should be kept in a well-corked bottle. The salt is readily soluble in hot or in cold water. Its solutions keep well, but should not be put into stoppered bottles, as they make the stoppers stick. Anhydrous sodium carbonate is a fine, white powder. It can be substituted for the crystalline form by multiplying the quantity of the crystals by five and dividing the result by fourteen. The result is then the corresponding quantity of the anhydrous.

Sodium Sulphide.—What is known as pure crystallised sodium sulphide is the substance referred to under this name. It is generally to be met with in large, greenish-white, wet-looking crystals. As it rapidly absorbs moisture from the air it should not be kept in stock for any long period. In concentrated solution it will keep for a few months.

Sodium Sulphite (not to be confused with sodium sulphide or with sodium sulphate).—It should be in the form of clean waxy-looking crystals with very little white powder adhering to them. It must be kept in a well-corked bottle. It may be dissolved in hot or cold water. If the sulphite crystals have a coating of white powder on them, but are clean and bright underneath, a little extra may be allowed in weighing out, the crystals given a rinse in cold water for a moment to remove the powder, this water thrown away, and the washed crystals dissolved in the usual way. This should always be done when making up an amidol developer if the sulphite is not quite clean. Anhydrous sodium sulphite is a fine white powder, and weight for weight, is twice as strong as the crystals. Stock solutions of sulphite must not be kept.

Thiocarbamide.—This should be in the form of a white powder.

Weights and Measures.

THE general custom in formulæ is to use the word "ounce" to imply the apothecaries' ounce of 480 grains, but if the worker seeks to buy an ounce of any chemical from his chemist he will be served with the avoirdupois ounce of $437\frac{1}{2}$ grains. Hence arises a little inconvenience, since an ounce avoirdupois as bought is insufficient to make up a formula in which an apothecaries' ounce is prescribed. Fortunately for the photographer, it is only rarely that the difference of approximately 10 per cent. between the two "ounces" is likely appreciably to affect his results. In this book, whenever absolute accuracy is desirable, grains are specified instead of fractions of an ounce. In the case of pyro, which is usually sold in ounce bottles, it will be sufficient if the whole ounce is dissolved as bought, and most formulæ are based on the assumption that this will be done.

A most convenient way of measuring small quantities of chemicals such as potassium bromide is by means of percentage solutions. It will be sufficient for all practical purposes to consider a 1, 5, or 10 per cent. solution as one in which one, five, or ten units by weight of a salt is dissolved in water (or other liquid) to make 100 units by volume of solution. For example, a 10 per cent. solution is one in which 1 ounce (480 grains) is dissolved in water to make 10 ounces (4800 minims) of solution. Then every ounce of this solution will contain 48 grains of the salt, every dram 6 grains, every 10 minims 1 grain, and every minim (or drop) $\frac{1}{10}$ grain.

In this book the quantities given in the metric system are not the equivalents of the corresponding quantities in the British

system. The proportions are approximately the same, but the quantities have been arranged so that the bulk shall be the most convenient in each system.

Water is given in fluid ounces.

BRITISH MEASURES.

APOTHECARIES' WEIGHT.

(By which formulæ are made up.)

20 grains	=	1 scruple.		
3 scruples	=	1 dram	=	60 grains.
8 drams	=	1 ounce	=	480 „

AVOIRDUPOIS WEIGHT.

(By which chemicals are sold.)

437½ grains	=	1 ounce.	
16 ounces	=	1 pound	=7000 grains.
¼-ounce	=	109 grains (approx.) ; ½-ounce	=219 grains (approx.).
¾ „	=	328 „ (approx.).	

FLUID MEASURE.

60 minims	=	1 dram.	
8 drams	=	1 ounce	= 480 minims.
20 ounces	=	1 pint (in U.S.A. 16 ounces = 1 pint).	
2 pints	=	1 quart	= 40 ounces.
4 quarts	=	1 gallon	= 160 „

THE METRIC SYSTEM.

There are three principal units—namely, the metre, the litre and the gramme—the units of length, capacity and weight respectively. Multiples of these units are obtained by prefixing to the names of the principal units the Greek works deca (10), hecto (100), and kilo (1000) ; the sub-multiples or divisions are obtained by prefixing the Latin words deci ($\frac{1}{10}$), centi ($\frac{1}{100}$), and milli ($\frac{1}{1000}$). These prefixes form the key to the whole system.

LINEAR MEASURE.

10 millimetres	=	1 centimetre	=	·3937 inch.
10 centimetres	=	1 decimetre	=	3·937 inches.
10 decimetres	=	1 metre	=	3·281 feet.

MEASURES OF WEIGHT.

10 milligrammes	=	1 centigramme			=	·1543 grain.
10 centigrammes	=	1 decigramme	=	100 milligrammes	=	1·543 grains.
10 decigrammes	=	1 gramme	=	100 centigrammes	=	15·432 „
10 grammes	=	1 decagramme			=	154·323 „
10 decagrammes	=	1 hectogramme	=	100 grammes	=	3 ozs. 227½ gns.
10 hectogrammes	=	1 kilogramme	=	1000 „	=	35 ozs. 87½ gns.

FLUID MEASURE.

1	cubic	centimetre (c.c.)				=	17 minims.
10	„	centimetres	=	1 centilitre		=	170 „
10	„	centilitres	=	1 decilitre	= 100 c.c.	=	3·52 fl. ozs.
10	„	decilitres	=	1 litre	= 1000 c.c.	=	35·2 „

The gramme is the unit of weight; it is the weight of one cubic centimetre of distilled water at its temperature of maximum density, 39·1 Fahrenheit. The kilogramme, therefore, is the same weight as a litre of water.

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